THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

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## FINANCE AND INDUSTRY.

IT must be admitted that the methods by which trade is carried on in Great Britain are sometimes casual or unorganised. To take a concrete example, let the case be supposed of an inventor who holds a patent for something really valuable. Everyone knows to begin with that the inventor is often apt to be an erratic genius totally devoid of the special ability which, even with money at his command, would enable him to make a commercial success of his invention. Usually he has very little money, and there is no royal road by which he can set about getting it. Generally speaking, he hunts around in a casual sort of way, and meets some man who thinks he sees value in the invention, and through a greater or less number of intermediaries he finally gets into touch with a promoter who exploits the invention and the inventor, floats a very much over-capitalised company, and sets the company going with enough working capital to keep it afloat for a year. Gradually the shares drop in value from the premium at which the promoter unloaded them on a public tickled by a huge advertising expenditure. Shareholders sell out chiefly at a small loss, the total loss is distributed over a wide area, and the number who lose heavily is few, too few to make an effective protest. A good invention is thus lost or discredited. Properly and honestly applied, a tenth of the money would have ensured a success.

In Germany things are done differently. The industrial banks afford a means of bringing men into touch with capital. The banks have the command of the best technical advice, on which they can draw when investigating any proposition or invention that may be submitted to them. The inventor is kept within bounds and receives a fair reward for his work, and undertakings are set going with the minimum of expense.

It is quite true that some of the German monetary groups have sometimes gone too far in supporting undertakings of doubtful value, but this is not a necessary fault of the system. It has often happened from too great an anxiety to secure work for affiliated manufacturing establishments, and the anxiety to secure work for these establishments no doubt largely prompted the banks to advance capital for such undertakings as, say, the Victoria Falls Co.

These German banks, as we have often shown, make it their business to help the manufacturer. We say again that it ought to be possible to devise some means on the lines of the more cautious of the German industrial banks by which genuine industry should be furnished with capital. There is plenty of business to be carried on for which small sums of £3,000 or £5,000 would be ample. It seems to be practically impossible to get such small sums. The promoter class turns up his nose

at such small demands because they do not afford him his pickings. Hundreds of thousands are more to his liking. Men with money to invest can seldom be found. They yield only to the glamour of the promoter and his over-watered schemes, and will risk with him thousands of pounds, rather than put hundreds into a genuine business as principals. The German Industrial Bank collects the people's savings and applies them to industry. Some of the undertakings succeed well; some, no doubt, fail. The depositors in the bank, one and all, receive the average result of all the business done by the bank.

In our English system Smith happens to put his money into the good thing, and Robinson loses all his in a failure. Smith makes 300 per cent. and Robinson loses 100 per cent. In Germany each man would have made 100 per cent. profit and get back his capital also. The worst of our English system is that the man who finds the money for the success could have made an equal success had he found one-fifth the amount without the mediation of the promoter. And the man who pays his thousand to prove a thing to be a failure could have proved it equally so by expending two hundred, and might even have made a success by expending three hundred. But the promoter has had seven-tenths of his thousand pounds, and thus to make this one man rich a good business is spoiled by lack of working capital, and a thousand investors are left to curse "industrials." It is the promoter who should be cursed. He is indispensable as matters stand, but we want a Censor who will limit the voraciousness of his appetite. The big promoter to-day cares little for the success of his companies. A company, with its offshoots and subsidiary companies, its re-absorptions, may be made merely a machine to be worked to extract shareholders' money under the protection of the law. Any group of men can work the game, which has many variants. A small proprietary financing syndicate of the inner ring, a large industrial company and a large number of subsidiary companies to be put out and absorbed, amalgamated and divided, are the stock-in-trade, and the payment of commissions on all this chopping and changing is a perfectly legal matter to which the little syndicate is entitled.

When a company is promoted to work a patent the promoter's huge profits are made in the enormous enhancement of the value of the patent between the time when the initial syndicate purchase it from the inventor, and the time it parts from it to the company. When a promoter exploits an established concern, he extracts his great profit, perhaps, out of goodwill, and the value of a goodwill may be made very large if a business is capitalised on a 5 per cent. basis on the opinion of the amount of profit that the business will make. All the foregoing may be merely an elementary expression of an oft-repeated grievance, but it is as well that the subject should continue to receive attention. As we have before said in these pages, there appears to be a real need and opening for British industrial banking somewhat in the lines of the German Banks.

---

**The Marconi Patents.**

A CORRESPONDENT of the *Financial Times*, who appears to have some knowledge of the inner workings of the telegraph world, recently drew attention to the purchase by the Post Office of the six coastal stations of the Marconi Co., with the right to use all the Marconi Patents, existing and for a period of 14 years, for the small sum of £15,000, and inquired what assets the company possessed, seeing that the "master patent" would expire on June 2nd, 1910. The company replied, admitting that the patent in question was about to expire, but stating that it had long ceased to be regarded as of much value, and had, in fact, been valued in the accounts merely at the amount of patent fees, &c. No depreciation, therefore, had been necessary. On the other hand, the company possessed some 500 patents protecting details, besides the trans-Atlantic transmission stations and the numerous installations on board ship. The correspondent, however, who signs himself "Marconi Shareholder," returns to the charge in the *Financial Times* of October 9th, averring that £75,000 was paid by the company in cash or shares to Mr. Marconi for the "master patent," and asks what has become of the balance of the purchase price, after deducting the cost of the letters patent. By the company's own statement, it has not been written off.

This shareholder acquired his holding in 1901, when the market price was considerably above the present figure, and when the attempts to signal across the Atlantic were just about to afford some indications of success. But trans-Atlantic transmission even now can hardly be regarded as a commercial success, and to crown all, the Canadian station has been burnt. What assets, he asks, have the shareholders to set against the £500,000 capital issued by the Marconi Co.—not counting loans—a capital big enough to lay an Atlantic cable?

Our sympathies must be with the unfortunate shareholders who, as this one says, "have had no luck." But our conscience is free from blame, for we have consistently urged caution upon prospective investors in the undertaking, and have pointed out the limitations of the system. Within those limits, it has been so successful as to become indispensable; but the company's policy was too long directed towards sensational enterprises of little utility—except to cause violent oscillations in the price of the shares. Since the reorganisation of the directorate wiser and more prosaic counsels have prevailed, and if the company perseveres in the straight, if unexciting, path of patient industry and sound development, we do not doubt that in the long run even "Marconi Shareholder" will be consoled for his earlier misfortunes. It is curious to observe that not only in this country, but also in the United States, the progress of the science has been delayed and hampered by errors of management and over-capitalisation, and in the States it is in a deplorable condition. Only our German cousins appear to have acted on a methodical plan, combining instead of dividing their forces, and it is from them that competition will come, for which our British companies had better be prepared.

---

**A Manchester Charge.**—At the Manchester City Police Court on Tuesday (12th inst.), Edwin A. Wilson, of Halliwell Lane, Hulme, was charged with having stolen electrical goods, including tantalum lamps, wire, &c., to the value of £500, the property of Baxendale & Co., Miller Street, Manchester, his employers. Several other men were charged with receiving the goods. Mr. Rylands prosecuted. Wilson pleaded guilty to the charge, and said he was ready to give evidence against the men charged with having received the goods, knowing them to have been stolen. Mr. Lustgarten, who appeared for the prisoner, said Wilson had practically grown up in the firm, having been there for 20 years, and his father had been manager of the firm for 40 years. The stipendiary postponed sentence until the other cases should be tried. Edwin Kay, an electric wireman, of 18, Parson's Lane, Bury, was charged with receiving part of the goods. Evidence was given that on October 4th he went into the shop; Wilson was behind the counter, and a man named Bradshaw was watching. There had been complaints of tantalum lamps having been sold below what was called a "maintained" price. Kay was served by Wilson, and received a big parcel from him. Kay had paid 11d. He was fetched back, and denied knowing there was more in the parcel than he had paid for, but it was alleged that he afterwards pleaded guilty. Wilson, the first prisoner, gave evidence that Kay had received several of the stolen articles, and had not paid for them. Fredk. Mason, an electrician, of Lever Street, Manchester, was charged with having received about £100 worth of goods which had been stolen. About 1,000 of the lamps which had been sold by him had been traced by Detective Winter. Prisoner pleaded guilty. All four prisoners were remanded for a week, bail being granted only to Harry Wilson, of Stockport.

## ELECTRIC TIME SERVICE IN EASTERN OBSERVATORIES.

By R. M. H.

Some little time ago an article appeared in the Electrical Review, in which were described at length the arrangements made by Mr. E. D. Pearmain to secure the advantages of an electric time service in connection with the astronomical installation at the Observatory in Mauritius, and in the course of the article Mr. Pearmain referred to a desire to possess specially constructed master clocks to take the place of those which were constructed on the spot. It may be of interest to readers who are concerned with this particular application of electrically controlled and operated mechanisms to know that this desire has recently been accomplished, and how the services have been arranged.

Two new master clocks have been made in this country, and the writer has had an opportunity of becoming acquainted with the details of their construction; as he is not aware that any description of such mechanisms has before appeared in the Review—or, indeed, in any journal—he hopes that the following information may be of interest.

One of the clocks is provided with a mean-time, and the other with a siderial, pendulum. The general arrangement of the gear in each case is similar, as shown in

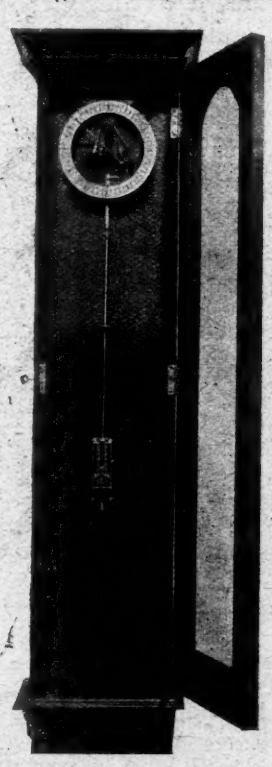

Fig. 1.—Master Clock, Mauritius Observatory.

fig. 1, an enlarged view of the mechanism being shown in fig. 2. The pendulum rods are made of Invar steel, and they are provided with adjustable devices of copper, by means of which the amount of relative compensation may be varied should such be found necessary. The usual provision for regulation by means of raising or lowering the pendulum bob is entirely absent, this being arranged for by the attachment to each rod of a small tray, which may carry more or fewer small weights as required, and in addition a heavy nut is provided which may be raised or lowered by screwing up or down on the rod. The nut is graduated, to enable a close adjustment to be arrived at without the necessity for lengthy experiment. The pendulum bob is supported by means of a steel pin which passes through both bob and rod somewhat below the centre of the former, as will be seen in fig. 1. The position of the pin is so fixed in order that the bob may be approximately self-compensating as regards its own mass.

The pendulum receives an impulse every alternate second by means of the gravity lever which will be observed in fig. 2 crossing the pendulum at right angles. This lever is pivoted at its left-hand end, and when released, by the disengaging of a trip lever on the swing of the pendulum to

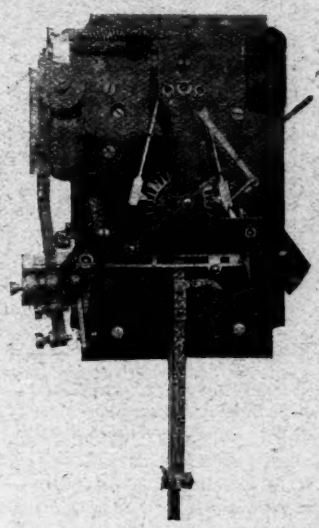

Fig. 2.—Master-Clock Movement, Mauritius Observatory.

the right, falls, communicating an impulse to the pendulum through the medium of a roller which it carries acting on an inclined plane, which, as will be seen, projects from the right-hand side of the pendulum. Having fallen and given up its kinetic energy to the pendulum, a bell crank prolongation of the lever which projects downwards makes contact with a screw point carried upon an extension of the armature of an electromagnet. This completes a battery circuit through the magnet, and the armature being attracted, the gravity lever is restored smartly to its potential position ready for the next impulse. The momentum of the gravity lever carries it slightly beyond the travel of the screw fixed to the armature, so that at the instant when the trip lever engages with the gravity lever the circuit is broken and the armature falls back. This cycle takes place entirely during one swing of the pendulum, so that the second swing is entirely free. It will be noticed that the lever gives its impulse directly to the pendulum, intermediary wheel work being eliminated. The presence of an element introducing the risk of a variable friction factor, as would be inherent with a train, is therefore entirely obviated. The suspension of

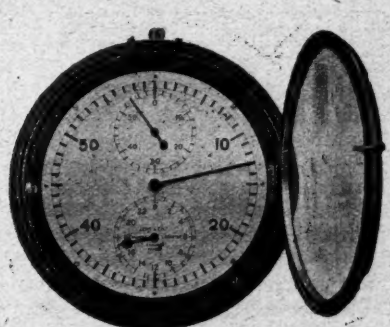


Fig. 3.—Secondary Dial, Mauritius.

the pendulum has received a good deal of attention from the makers. The thickness of the spring is selected with regard to the weight of the pendulum, and it is placed between brass cheeks finished to surfaces as plane as it is possible to get them. All the pivots are carried in jewels.

The pendulum of the mean-time clock is fitted with a device by means of which its beat may be retarded or accelerated through a fraction of a beat. This consists of a tungsten steel permanent magnet, fitted to the rod so as to oscillate in juxtaposition to the poles of a pair of solenoids carried on brackets fixed to the case. A reversing switch enables either positive or negative currents

to be circulated through the solenoids, so that if the magnet be attracted, the pendulum will be accelerated, whilst if the the magnet be repelled the pendulum will be retarded. As such correction is necessarily slow in operation, it may be

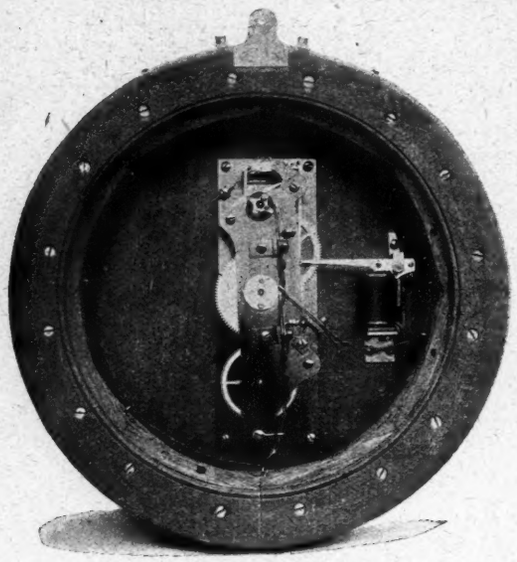

Fig. 4.—Mean Time Dial, Mauritius, with Hourly Contacts, &c.

used for minute correction to the beat of the pendulum; it does not, moreover, interfere with the fixed adjustment governing the normal rate of the pendulum.

The contacts which are made by the pendulum to provide energy for the continuance of its motion are very brief, varying from 0·025 to 0·05 second, and this duration is self-controlling, inasmuch as it depends upon the rate with which the magnet restores the gravity lever, which in turn depends upon the self-induction in the whole circuit. It is found that, although the contacts occur very frequently (every alternate second, as explained above), the duration is so minute that the installation may be worked from ordinary Leclanché cells without putting an undue drain upon their capacity. Owing to this fact, this installation will prove more economical in battery maintenance than the

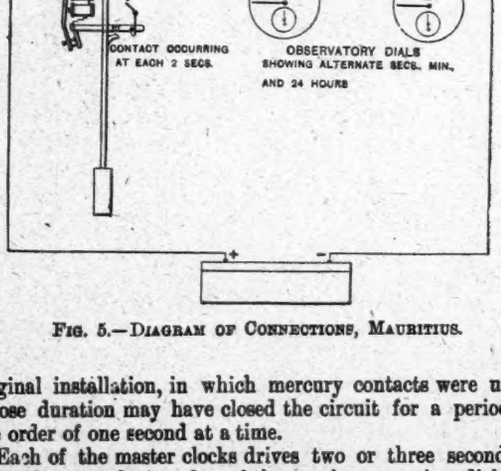


Fig. 5.—Diagram of Connections, Mauritius.

original installation, in which mercury contacts were used, whose duration may have closed the circuit for a period of the order of one second at a time.

Each of the master clocks drives two or three secondary dials (figs. 3 and 4). One of these—the mean-time dial—is fitted with supplementary contacts to enable the time ball to be dropped. In this clock the circuit is completed at each 60th second by means of a contact fitted upon the seconds arbor. This circuit, however, includes, in series with the foregoing contact, an auxiliary contact fixed to the minute arbor. The latter arbor revolves once in an hour, and only at the 59·5th minute this contact is closed to enable the circuit to be completed by the contact upon the seconds arbor. Therefore, at the 60th second of the 60th minute of each and every hour the circuit is completed for the release of the time ball. The springs for these contacts may be seen in fig. 4. One of the secondary clocks driven by the siderial-time pendulum is arranged so as to break the circuit each minute.

The writer would here like to compliment Mr. Pearmain upon the design and construction of the time-ball mechanism, as well as upon the manner in which, having regard to the local difficulties he had to contend with, he achieved an efficient time service for the island.

Fig. 5 shows in diagram form the electrical arrangements for one of the pendulums and dials, showing that the latter are connected in series. It may be mentioned that there is practically no limit to the number of secondary clocks which may be so connected, provided the voltage applied to the circuit is suitably increased for every additional dial included, the circuit being operated on a constant-current value principle.

Whilst the writer was engaged in the absorption of the details of the Mauritius system, as explained above, he came across details of a similar system, but differing in one or two

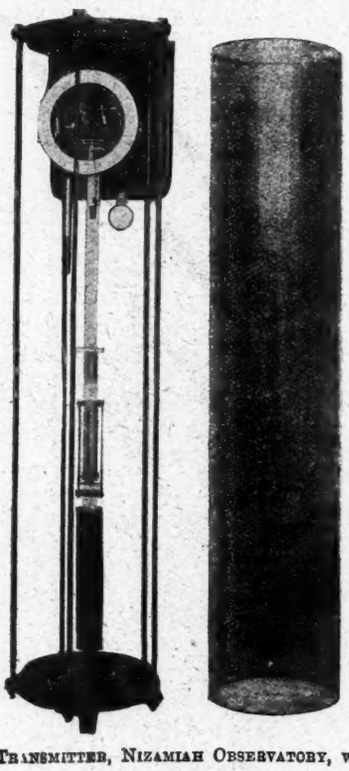

Fig. 6.—Transmitter, Nizamiah Observatory, with Glass Cylinder Removed.

rather important details, so as probably to make it interesting to readers of the foregoing matter. This apparatus was designed and manufactured by the same makers to the order of Mr. A. B. Chatwood, F.R.S.A., Astronomer to the Nizam of Hyderabad, for the new Nizamiah Observatory.

The construction of the master clock pendulum is essentially the same as that of those described above, but it is arranged that, instead of every alternate second, the impulse is given to the pendulum once in every six seconds. Two additional contacts are fitted to the rod, close to the suspension—where their disturbing effect is reduced to a minimum—and by these the secondary clocks are enabled to indicate every second. This offers certain advantages where transit observations are concerned, and only a slight disadvantage; the greater frequency of the contacts slightly increasing the cost of battery maintenance over that of the Mauritius system.

The master clock (fig. 6) is enclosed within a novel type of case of somewhat more than passing interest. The whole of the mechanism is enclosed within a hermetically sealed glass cylinder. (In the figure the glass is shown removed.) The iron casting at the top carries the mechanism, and in the bottom is a hand-hole closed by a removable

iron cover, through which access to the pendulum may be had for regulating purposes without removing the glass cylinder. The bottom casting carries also a small non-return valve and connection to which an air-pump may be attached, so that the interior of the case may be maintained at a constant air pressure; and, in order that no leakage of air may take place, india-rubber packing is placed between the castings and the glass cylinder, the terminals passing through air-tight glands in the casting. In order that both pressure and temperature may be observed, an aneroid barometer and a thermometer are fixed within the cylinder.

The secondary clocks, of Mr. Chatwood's own design, were provided with white figures on a platinum black ground. It is claimed that this enables the dials to be read with greater facility.

The circuit arrangements (fig. 7) differ materially from the Mauritius arrangements, inasmuch as the dials—which also may be any number, the voltage being suitably arranged

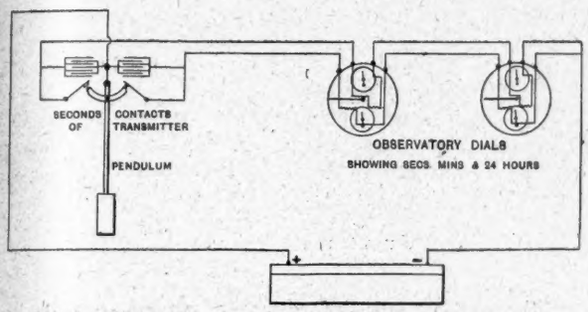


Fig. 7.—Circuit Arrangements, Nizamiah Observatory.

—are operated by two independent circuits, controlling the action of two electromagnets in each dial, each of the contacts on the pendulum operating one magnet, so that the even seconds are indicated through one circuit and the odd seconds through the other. It will be observed that a condenser is joined across the master-clock contacts so as to absorb the spark.

The writer should add, in conclusion, that he is indebted to the courtesy of the makers, Messrs. Gent. & Co., Faraday Works, Leicester, who make a speciality of this and other classes of electrical time work, for the illustrations and much of the information which has enabled him to place descriptions of these interesting installations before the readers of the Electrical Review.

## CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

(*Continued from page* 570.)

Fig. 42 affords graphic comparison between Z to L and C to L sets of bridge readings to scale zero on an artificial copper exposure of ½ in. (core 400 Cu/360 G.P.) connected to an inserted resistance of 1,050 ohms.

Fig. 43 shows how the trend of a series of readings and of the corresponding curves may be affected by the *condition* of the iron sheathing wires of the broken cable. The two sets of curves here shown are from a real recovered broken end of 500 Cu/360 G.P. core with 9-in. exposure in salt water (wires unstranded) and contiguous sheathing in one instance (*a*) of new galvanised iron wires, and in the second instance (*b*) an approximately equal superficial area of old rusty iron sheathing picked up with the broken end. Naturally the water-column apparent resistance between the copper exposure and the iron sheathing was increased by the rust, thus causing the corresponding curve to deflect from the vertical much more than does the curve from the same core exposure with the new and galvanised sheathing.

Fig. 44 gives two graphs of actual localisation tests made by the writer on a repair of one of the French Atlantic cables (core 350 Cu/300 G.P.).

The ordinary Jona set of plottings (A) shows plotted on a calculator-board, ship's test to break from ship's cut-in.

Ship picked up to break 0·78 N.M. of recovered cable, the measured C R of which was about 2 ohms. The inserted resistance between bridge and cable had been 992 ohms.

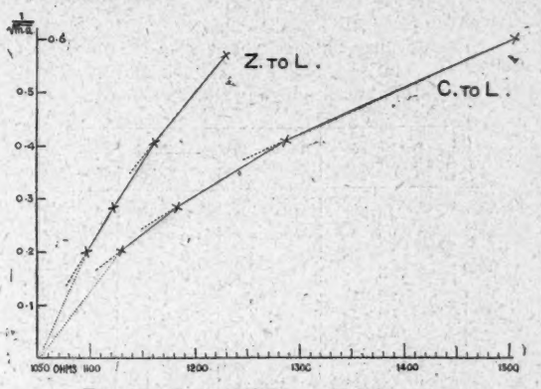


Fig. 42.—Core 400/360 lb., ½" Exposure.

In fig. 44 the set of plottings (B), likewise from a calculator-board, affords an interesting instance of the writer's application of Jona's graphic system to the localisation of *partial earth* faults. The plottings marked with a *cross* show

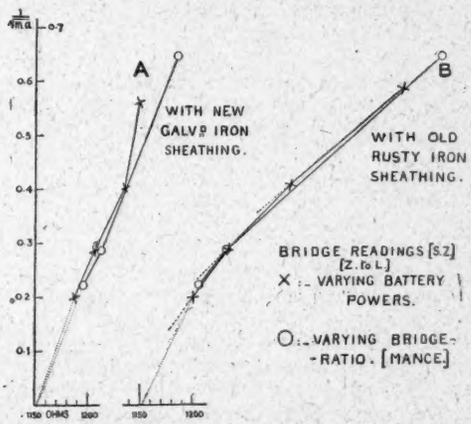
A
B
WITH NEW GALV^D IRON SHEATHING.
WITH OLD RUSTY IRON SHEATHING.
BRIDGE READINGS [S.Z] [Z. to L.]
X :- VARYING BATTERY POWERS.
O :- VARYING BRIDGE-RATIO. [MANCE]

Fig. 43.—Core 500/360 lb., 9" Exposure (Wires Unstranded).

results of bridge tests with various battery powers. The *circles* show Mance readings with a constant voltage and varying bridge ratios.

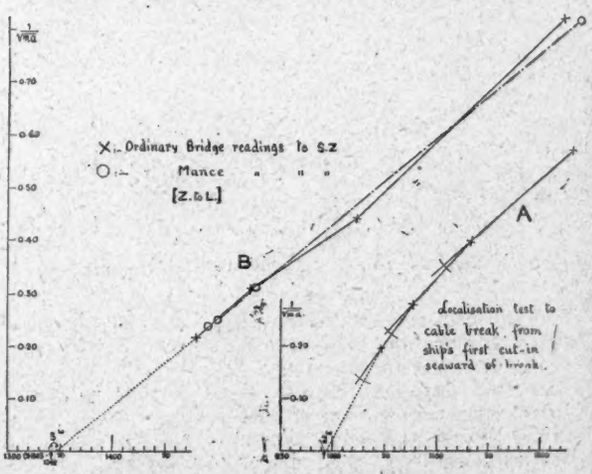
X :- Ordinary Bridge readings to S.Z
O :- Mance " " "
[Z. to L.]
A
B
Localisation test to cable break from ship's first cut-in seaward of break.

Fig. 44.—Actual Cable Tests—Core $\frac{350 \text{ lb. Cu}}{300 \text{ lb. G.P.}}$.

**Test to localise partial earth-fault between ship's second cut-in and shore. Cable end "free" at cable house.**

The trend of the curve showed the fault to be a few ohms from ship. In fig. 44 (B) the dotted line is drawn to the

D

true ohmic position of the fault on the line of resistance as proved by length of cable picked up to the fault, and is seen to be absolutely in line with the Mance readings.

Distance of fault from ship was 1,347-1,342 = 5 ohms. An earth overlap made (under unfavourable conditions) to corroborate the above result gave 6 ohms, which proved to be 1 ohm in excess.

As the foregoing two graphs are good representative examples of tests respectively to a break and to a *partial earth* fault, full figures are here given.

| Series A. | Leclanché cells (Z to L) | Milliamperes (M.A.) | $\frac{1}{\sqrt{\text{M.A.}}}$ | Bridge readings to scale zero (992ω deducted). |
|---|---|---|---|---|
| | | | | ω |
| 1 | 40 | 25·5 | 0·198 | 54 |
| | 20 | 12·8 | 0·279 | 84 |
| | 10 | 6·3 | 0·398 | 139 |
| | 5 | 3·1 | 0·568 | 231 |
| 2 | 40 | 26 | 0·196 | 53 |
| | 20 | 12·8 | 0·279 | 84 |
| | 10 | 6·3 | 0·398 | 139 |
| | 5 | 3·1 | 0·568 | 238 |

| Series B. | Leclanché cells (Z to L) | Milliamperes (M.A.) | $\frac{1}{\sqrt{\text{M.A.}}}$ | Bridge readings to scale zero (1,342ω deducted). |
|---|---|---|---|---|
| | | | | ω |
| 1 | 40 | 21·9 | 0·214 | 133 |
| | 20 | 10·7 | 0·306 | 191 |
| | 10 | 5·2 | 0·439 | 288 |
| | 5 | 2·5 | 0·816 | 488 |
| 2 | 40 | 21·5 | 0·216 | 137 |
| | 20 | 10·7 | 0·306 | 189 |
| | 10 | 5·2 | 0·439 | 288 |
| | 5 | 2·5 | 0·816 | 488 |
| 3 | 40 | 21·5 | 0·216 | 138 |
| | 20 | 10·7 | 0·506 | 189 |
| | 10 | 5·2 | 0·439 | 288 |
| | 5 | 2·5 | 0·816 | 488 |

20 Leclanché cells, Z to L.

| Series B. | Bridge ratios. | M.A. | $\frac{1}{\sqrt{\text{M.A.}}}$ | Bridge readings to scale zero (1,342ω deducted). |
|---|---|---|---|---|
| | | | | ω |
| 4 | $\frac{10}{10}$ | 18 | 0·236 | 149 |
| | $\frac{100}{100}$ | 16·8 | 0·244 | 158 |
| | $\frac{1000}{1000}$ | 10·7 | 0·306 | 193 |
| | $\frac{10000}{10000}$ | 2·5 | 0·816 | 504 |
| 5 | $\frac{10}{10}$ | 18 | 0·236 | 149 |
| | $\frac{100}{100}$ | 16·8 | 0·244 | 158 |
| | $\frac{1000}{1000}$ | 10·7 | 0·306 | 193 |
| | $\frac{10000}{10000}$ | 2·5 | 0·816 | 504 |

Fig. 45 (A) shows a graph localisation made by the writer from cable ship *Dacia* on one of the Atlantic cables, from ship's first cut-in on the Newfoundland banks, to ascertain the distance of a break which had interrupted the working of the cable, and which the *Dacia* had crossed the Atlantic to repair.

Tests from terminal stations had pointed to the break as having occurred, more or less, on a slope near the edge of a submarine bank, and much depended on *exact* knowledge as to the locality of the break and depth of water in which the broken ends of the cable lay.

On the strength of the information afforded by graph fig. 45 (A) the break was reported to be between seven and eight nautical miles from ship. Subsequently ship picked up 2·7 N.M. of core 500/320 + 4·9 N.M. of core 400/360 = total 7·6 miles of cable to break. Copper exposure was found worn to conical shape. Length of exposed wires of copper strand from 0·6 in. to 0·25 in.

The dotted line in fig. 45 (A) indicates that point on the line of resistance proved by subsequent tests on the recovered cable (corrected for temperature) to have been the true ohmic resistance between ship's first cut-in and break, viz., 1,232 — 1,213 ohms (inserted resistance) = 19 ohms to break.

Ship then hooked and cut in a short distance to the other side of break, spliced on ship's cable, straightway filled up the gap and completed the repair within the confines of the bank, and without having to deal with any great depth of water.

Fig. 45 (B) is of mere academic interest, showing, as it does, a graph of tests made after the completion of the aforementioned repair, on the short end between ship's second cut-in and the break.

It was known that this short piece could not amount to a mile of cable, so naturally by the time the buoyed short end had been picked up, passed round the drum and into the tank, up into the test box, opened out and joined through to the testing room, the broken end of the short piece being picked up was well "on the move," which fact fully accounts

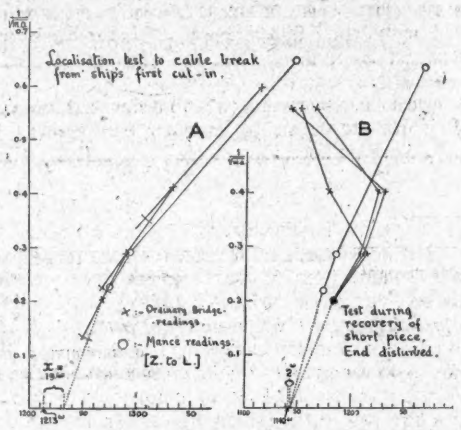
Localisation test to cable break from ships first cut-in.
A
B
× :- Ordinary Bridge readings.
○ :- Mance readings [Z. to L.]
Test during recovery of short piece. End disturbed.

Fig. 45.—Actual Cable Tests—Core $\frac{400 \text{ lb. Cu}}{360 \text{ lb. G.P.}}$.

for the erratic lay of the curves plotted with *crosses* at those portions determined by the *lower current* readings. This second exposed end (Cu/400 lb. per N.M.) consisted of wires varying in length between 0·6 in. and 1 in.

Without dogmatising as to the exact interpretation of these clearly supererogatory tests made on a short end whilst it was being picked up, the writer suggests that some explanation may be derived from a consideration of the following facts; this by way of a useful exercise on the influence of testing currents on copper exposures.

(*a*) Jona curves plotted under the conditions governing the curves hitherto shown in this work—viz., Z to L, against the negative polarisation current from the exposed end—normally lie from the lowest current plotting up on the right of the curve sheet, down towards the highest current plotting on the left.

(*b*) As will be shown and explained later on in the present work, a series of Z to L bridge readings on a broken cable from which, at the testing end, an appreciable *positive* current is flowing, would, if plotted, form a curve with a trend in a direction opposite to that of the curve mentioned in (*a*), and useless as an index of true resistance up to the break, for under these conditions the higher of two currents will be found to produce on the bridge the higher—not the lower—resistance reading.

(*c*) The erratic *cross*-plotted curves in fig. 45 (B) were obtained whilst the exposed end was being subjected to considerable mechanical disturbance by being dragged along the bottom of the sea through the water, now and again, perhaps, digging into the mud or sand. Thus, the gas due to the polarising effect of ship's *zinc* testing current would, doubtless, be repeatedly washed or knocked off as soon as it formed, thus tending to leave the *positive* current from the iron-copper couple at the broken end free to pass along the cable towards the testing end, in place of the negative polarisation current met with under normal testing conditions. This—from the appearance of the curves in fig. 45 (B)—would appear to have been the case with the lower current values, these naturally having been more easily affected by the passing of the end through the water than were the higher current values. These last mentioned appear to have been strong enough to polarise the broken end sufficiently to induce and *maintain* at the broken end a *negative* potential sufficient to bring the lower portion of the curves in fig. 45 (B) into the category of normal conditions. This rationale would account for the distinct set over to the left of the lower current portion of the *cross*-plotted curves as compared with the correct trend of the higher current portions.

In the practical example under consideration, the broken end was picked up and brought in board before the writer had time to repeat the tests Mance fashion, *i.e.*, with a constant battery and varied bridge ratios. This second broken end, namely, that of the short piece picked up was, therefore, after its recovery, immersed in salt water in a sheathing-earthed iron bucket. On this being done the Mance balances shown by the *circle*-plottings in fig. 45 (B) were observed, and all readings—now that the broken end was still—were found to be absolutely steady.

## Polarity of Test Currents.

Although, for well-known reasons, break or fault tests involving an exposure of the cable conductors are, as a rule, made with the *negative* or zinc current to line (as this current does not, under ordinary conditions, cause the exposed copper to polarise) cases sometimes occur when workable results can be obtained only with the *positive* or carbon current applied through the Wheatstone bridge to line.

On these occasions the exposure is found to polarise under the zinc current, and to break down or decrease in resistance under the carbon—a characteristic quite contrary to the generally received customary procedure.

Then, again, under these same conditions, any increase in power Z to L naturally results in increased bridge readings, and the customary law as to increase in current producing a decrease in the bridge readings balancing the broken or faulty cable is found to apply only when the tests are made C to L.

All the actual instances of this reversal of the usual order which have come under the writer's notice have been connected with tests on heavy-core cables with a copper exposure at the break of considerable superficial area. In some cases there has been evidence, when the ship has picked up to the break, that the exposed copper has been buried, when both the setting free of the hydrogen evolved by the zinc current, and the formation of the cupric chloride salt under the carbon current, must have been greatly discouraged.

Where, then, a large exposure is buried in wet mud or sand, the main source of current from the exposed conductor will be the battery element set up between the copper conductor and the iron cable sheathing through the intervening electrolyte of wet mud or sand. The larger the exposure, the less will be the tendency for it to polarise, and the less affected will be the naturally *positive* polarity of the copper of this fault battery by the action of a testing current applied at the ship's end of a cable.

With a *positive* fault-battery current flowing from the cable at the testing end, an increase in voltage Z to L applied to the cable would—in the absence of polarisation, with its consequent reversal of the current reaching the testing end of the cable from the break—be accompanied by an increased bridge reading, whereas, under these conditions, with C to L, an increase of current would produce a decreased bridge reading. That this is so will be proved graphically further on.

The following is a table of actual results obtained in tests for the localisation of cable breaks, in which the use of Z to L testing current proved impracticable. Useful results were obtained by ship only with C to L.

These figures, for which the writer is indebted to Mr. F. C. Crawford, were obtained in 1904 on the C.S. *Dacia* during a repair of one of the Atlantic cables.

$$\left(\text{Core} = \frac{400 \text{ lb. Cu}}{360 \text{ lb. G.P.}} \text{ per N.M.}\right)$$

The exposed conductor at the break eventually proved to extend to 2 in. of opened-out copper strand.

Fig. 46 shows Jona's graphic method applied, by means of the writer's calculator board, to the figures given in the foregoing table.

Test *d* in series 1, although in the right direction in regard to the action of increased testing current (in this case C to L) proved useless with a calculated result of *minus* 13 ohms, solely owing to insufficiently strong testing currents having been brought to bear on a copper exposure of considerable superficial area.

| Series. | Tests. | Cells, Leclanché. | Z or C to L. | Milli-amps. to break. | Resce. added to cable. | Bridge. rdgs. (To S. Z.) | — |
|---|---|---|---|---|---|---|---|
| 1 | *a* | 20 | Z | 10·0 | 1,900 | 1,959 | |
| " | " | 10 | " | 5·1 | " | 1,929 | Useless. |
| " | " | 5 | " | 2·6 | " | 1,853 | |
| " | *b* | 20 | " | 10·1 | " | 1,947 | |
| " | " | 10 | " | 5·1 | " | 1,917 | " |
| " | " | 5 | " | 2·6 | " | 1,850 | |
| " | *c* | 20 | " | 10·1 | " | 1,933 | |
| " | " | 10 | " | 5·1 | " | 1,905 | " |
| " | " | 5 | " | 2·6 | " | 1,886 | |
| " | *d* | 20 | C | 9·8 | " | 1,998 | Negative result. Currents of insufficient strength. |
| " | " | 10 | " | 4·8 | " | 2,057 | |
| " | " | 5 | " | 2·3 | " | 2,168 | |
| 2 | *e* | 40 | Z | 21·8 | 1,600 | 1,683 | |
| " | " | 20 | " | 11·1 | " | 1,669 | Useless. |
| " | " | 10 | " | 5·6 | " | 1,640 | |
| " | *f* | 40 | C | 21·9 | " | 1,671 | |
| " | " | 20 | " | 10·9 | " | 1,697 | Fair result—viz., 27°. |
| " | " | 10 | " | 5·4 | " | 1,741 | |

Nore.—In attempts to make a Kennelly two-current test to false zero similar impracticable results were obtained, the higher current being accompanied by the higher bridge reading. The customary trend of current and bridge readings was obtained only with a carbon testing current.

Taking the first successful test in the foregoing series, viz., test *f* in series 2, we have—

$$1{,}671 + 1{,}697 - 1{,}741 = 1{,}627 \text{ ohms.}$$

$$1{,}627 - 1{,}600 \text{ (added resistance)} = 27 \text{ ohms.}$$

Correct resistance up to the break eventually proved to be 24 ohms. The conductor (400 lb. Cu. per N.M.) was found to be exposed for 2 in. Mud on centre wire indicated that the broken end had been buried.

Fig. 46 shows graphically, by Jona's method of plotting (Z to L), tests *a*, *b*, *c*, and (C to L) *d* in series 1, also (Z to L) *e* and (C to L) *f* in series 2 as given in the table.

From series 1 and 2 we see that in these examples :—

1. Curves plotted from Z to L readings lie in a wrong direction and are useless for indicating the point on the resistance line representing *x* or resistance up to the break.

2. Curves plotted from C to L readings lie in the right direction.

3. The curve for test *d* (C to L) in series 1 has a trend indicating something less than the added resistance of

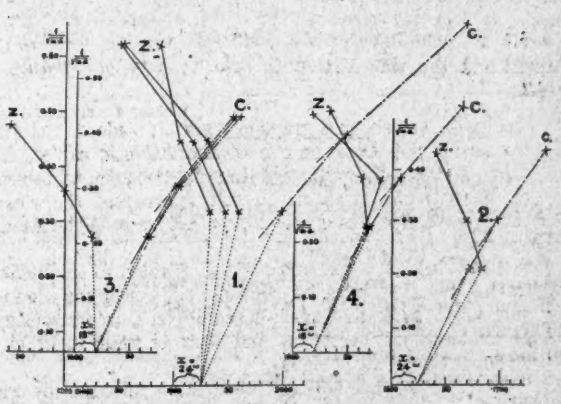


Fig. 46.

Actual cable tests affording an instance of the impracticability—under certain conditions—of usual localising routine with negative currents, with consequent employment of positive currents.

$$\text{Core } \frac{400 \text{ lb. Cu}}{360 \text{ lb. G.P.}}$$

1,900 ohms, in other words, a *negative* result due to insufficiently strong testing currents as already shown in the foregoing table.

4. The curve for test *f* (C to L) shows how, with increased positive currents, a satisfactory result was obtained.

Fig. 46 likewise includes other series, viz., 3 and 4, showing actual tests subsequently made in connection with the same work as that already alluded to. Here it is seen how,

on the occasion in question, the only satisfactory results obtained were with the *positive* or carbon current to line.*

In all these graphic examples obtained from plottings on a calculator board, dotted lines have been drawn connecting the curves severally with the correct points for $x$ on the resistance line as proved when the ship had picked up to the break.

(*To be continued.*)

## CORRESPONDENCE.

***Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.***

### Coefficient of Self-Induction.

In reply to the letter from Messrs. Smith and Cramp in your last issue, your reviewer finds it difficult to believe that they "have never suggested that the numerical relation between current and flux was other than a rational number." In your issue for October 1st, the following extract appears above both their names :—

"This definition does not appear to us to be inconsistent with the use of a complex number to express the coefficient. For, in the case of an alternating-current circuit in which iron losses affect the value and phase of the current, the ratio between that current and the magnetic flux undoubtedly involves a complex number."

Your reviewer leaves it your readers to reconcile these statements.

When there is iron in the core of a coil, the ratio of the flux to the current is not constant. This ratio is not only not constant, but it is a double valued function of the current. It, undoubtedly, has in general a different value when the current is increasing from what it has when the current is diminishing.

Your reviewer has never come across any sensible definition of self-inductance when the coil is immersed in a medium of variable permeability. He is therefore unable to answer the authors' misleading, or rather "leading," questions which postulate the existence of such a definition. With all due deference to the authors, Maxwell's energy definition, which is now adopted by all physicists, is quite correct and intelligible when applied to coils immersed in media of constant permeability. When applied to other cases it is intelligible, but the coefficient varying with the current and the time *cannot be used in a vector equation at all.*

**Your Reviewer.**

### Cost of Living in the Federated Malay States.

Referring to your article on this subject in your issue of August 20th, it is obvious that the article was written by "one who *has* lived there," and as it is so very difficult for people at home to get correct ideas of the cost of living in different parts of the world, I would suggest that you publish no articles of this kind unless contributed by a person actually on the spot at the time of writing, and who has lived in that particular district for at least three years.

Anyone residing in the Straits Settlements would be exceedingly surprised to see that the value of the dollar is given as "about 2s. sterling, but its value fluctuates with the silver market," as the value of the Straits dollar has been *fixed* at 2s. 4d. since about four years ago—personally, I came out to Singapore about 3½ years ago, and at that time I learnt, amongst other things, that the value of the dollar had been fixed at 2s. 4d. a few months previously. Hence, a European on a sterling salary now gets 8·57 actual Straits dollars as the equivalent of £1 sterling, instead of about $10 as before, so that anyone coming out on £20 per month would receive—not $200 more or less, but exactly $171·40; a very considerable difference, and particularly so when one bears in mind the fact that the purchasing power of the dollar is just the same now as when its value was fluctuating.

I received my copy of the Electrical Review only to-day, and I read this article with pained surprise; it is indeed disappointing to think that this kind of information cannot be relied upon, even when obtained through the pages of such a well-known paper as the Electrical Review.

For the use of anyone who happens to read this, and who may intend going abroad at any time, I might mention that a source of information not, I believe, taken advantage of so much as might be expected, is the Emigrants' Information Office, 31, Broadway, Westminster, S.W., which office, to quote from one of their handbooks, "was established by Her late Majesty's Government in 1886 for the purpose of supplying intending emigrants with useful and trustworthy information respecting emigration chiefly to the British Colonies and is under the direction of the Colonial Office."

Letters may be sent unstamped to the above office, and the handbooks cost generally, I believe, about sixpence each.

**Precision.**

Singapore, *September 10th*, 1909.

[We welcome "Precision's" criticism, as we are anxious to give exact information on the cost of living abroad; but does not he labour the point somewhat? The only item in the article to which he takes exception is the statement that the value of the dollar is "about 2s.," whereas it is now fixed at 2s. 4d. This cuts both ways; a man engaged at $200 a month will now receive the exact equivalent of £23 6s. 8d. instead of £20 more or less. Our contributor lived in the Straits Settlements for many years.—Eds. E.R.]

### Electric Laundry Irons with Indicators.

In our letter dated August 17th we drew your attention to a rule requiring indicating devices to be installed where electric laundry irons were in use in Australia.

We now beg to state that this rule has been suspended as far as South Australia is concerned.

*For* **Newton, McLaren, Ltd.,**
D. Eardley McLaren,
*Managing Director.*

Adelaide, S.A., *September 8th*, 1909.

### Electricity in Mines.

I am very much in agreement with you on the subject of the panic among the miners' leaders with regard to electricity in mines.

I think there ought to be experiments undertaken at the experimental gallery at Altofts, to see if the arc from a severed cable or a short-circuit will ignite coal dust when there is no fire-damp present. Of course, in the case of fire-damp, the present rules (which require revision) amply provide safeguards; but is the *coal-dust* danger real? I am sometimes inclined to think not, as all the experiments carried out, both here and on the Continent, have always been initiated by a small gas explosion or by a small cannon to represent a blown-out shot. Now in the vicinity of such initial explosion, the coal-dust laden atmosphere will be raised in pressure, as has been proved by the recording pressure instruments at an experimental gallery in Germany, which recorded a pressure up to 20 lb., by an explosion of fire-damp without coal dust. Has this rise in pressure not something to do with coal-dust explosions? It would not be present at the damaging of a cable by tubs or a fall of roof, which can easily be proved by experiment.

As to the danger from shock, this can be avoided by installing good plant and proper maintenance, and all unskilled and unauthorised persons when in doubt should switch off, or leave alone, and send for the electrician. Too much attention cannot be given to earth connections, when, if the earth detector is in good order, trouble should soon be located and put right. In conclusion, I think revising the present rules and raising the status of mining electrical

* Since the above was written the new and revised (2nd) Edition of Mr. H. D. Wilkinson's "Submarine Cable Laying and Repairing" has appeared, and, regarding the subject of the carbon being at times the only practicable current to employ for tests to a break, the student will do well to read the paragraph beginning half-way down page 397.

engineers by the formation of the Institute of Mining Electrical Engineers, will soon bring matters into a more satisfactory condition.

**Geo. Park, M.I.M.E.E.**

Pelton Fell, *October 8th*, 1909.

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### Inadequate Salaries for Technical Teachers.

I see by your last week's paper that a demonstrator is required by the electrical engineering department of the Dundee Technical College. The main qualifications are a technical degree and practical experience, while the successful candidate is expected to assist in the equipment of the laboratory. The salary is £80. This salary seems to the writer a totally inadequate one, and he is surprised that a department presided over by an M.I.E.E. should offer so meagre a salary when such qualifications are necessary. The salaries paid to technical teachers are, as the advertiser must know well, low enough, and it should be the endeavour of one who has risen to make things better for those who come after. What the equipment of a laboratory, while the ordinary class and lecture work is going on means, only those who have passed through such an ordeal know. The writer remembers reading a day or two ago that Barnet (Herts.) advertised for a handyman for a workhouse at 30s. per week, which works out at a little less than the £80 offered in the present case.

**A. T. T. I.**

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### Unemployment.

Having read with much interest the correspondence on unemployment and combination, I beg to ask the various writers if it is not possible to do something in the direction of organising at once and see if the electrical trade want a society or not. I suggest that all who are interested in this matter send in their names and views to the Editor of the ELECTRICAL REVIEW, the envelopes to be marked in the left-hand corner (Society), and I beg to ask if the Editor would kindly send all the correspondence to my address, which I enclose, and I will undertake to read over the matter and report through your columns the result, and from that we should be able to ascertain the views of the trade. I am firmly convinced that it will be better to do this than keep on talking.

There is no doubt the trade does want organising, and the sooner the better, the only difficulty seems to be that our trade has so many branches and too much of the looking down upon one another; the station assistant thinks himself above others, and so on, but if we are to get a standard rate of wages for the various branches and positions, would it not be better if all this was left on one side and try to form a body? Then it would, perhaps, be possible to agree to certain scales of wages for each section.

There are so many branches in the trade that most people think it impossible to organise, but you have only to look at the Amalgamated Society of Engineers, and you will see many branches in their trade, but each branch has its own rate of pay, and you don't find much falling out in their ranks.

In reply to Wm. Podmore, who suggests joining the A.S.E., I think it would be far better to have a separate society; there is plenty of room for one, and plenty of men in the trade to form one.

As for the proposed Engineers' Association, that is not what is wanted, it being on the same lines as the Institution of Electrical Engineers, which is of no use to the man who has to work for his living.

No doubt most people are aware that there is already an Electrical Trades Union, but the bulk of their members are wiremen; they do not make any provision for other branches, and even if they do, all candidates accepted are classed as wiremen, that being their main object.

What we want to do is to organise electricians, men who have served a specified time at the trade and can do wiring, and are capable of taking charge of plant and doing running repairs.

I appeal to all shift engineers and electricians in charge of plant to send in their names, views, and suggestions, as soon as possible, and then someone in each county can get into touch with all who are interested. I am willing to do my share in the North, and perhaps others will do theirs elsewhere.

**Unity is Strength.**

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My sympathies are with the unemployed, having been out of employment myself; but I feel that I cannot let Mr. Podmore's lament go unanswered: especially that part dealing with polytechnics and those taking advantage of the facilities offered by them.

I am a believer in the principle of the living wage, &c., but Mr. Podmore does not abuse the men on this point. In fact, Mr. Podmore gives himself away somewhat when he says, "as good mechanics and electricians are watching these robbers, and laughing as they drill a ⅝-in. hole in their brass." Now the point is this—these men are paid to work, not to watch and laugh at the efforts of others; that is their employer's business. If, instead of doing this, they took an intelligent interest in their own work, and watched the efforts of those who are cleverer and better men than themselves, they might then improve their own position; if not, in the monetary sense, they would in the esteem of their employers; and even that counts.

After all, the employers and their charge hands are the best judges of a man's capabilities and whether it pays to keep a certain man or not. If a man can do his work, it is immaterial to his employer where he gained his knowledge.

These polytechnic, &c., men are, as a rule, men who use their spare time and money for their future welfare, are not spoon-fed, and many have been compelled to rely on their own individual efforts; the consequence is, they make the most use of any opportunity which may occur, and succeed in life without taking any mean advantage of others.

Some little time back I had to examine the answers to an advertisement. The money and position were small; one man offered his services (had served his time), there was nothing in electrical work he could not do; he gave statistics showing day and year of birth; he worked out his own age, unfortunately for him he was a year out in his calculations. Another (he also had served his time) stated that he had passed "The Cities and Gilds" exams., I presume he meant "City and Guilds." There were over 100 applications; the majority of them displayed that curious combination of over-confidence and indifference.

A man should be judged by what he can do, not by what he ought to do and the amount of money his relations were able to spend on him as a youth.

All honour to those men whose parents were able to give them a fair start in life, but why abuse and refuse the right to work and live, provided the game has been played, to those who, like myself, as youths had to struggle against

**Adversity.**

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### Reversal of S.P. Motor.

I shall be glad if any of your readers can give me any explanation of the following singular occurrence. I have a 2-H.P. Fuller motor, 210 volts, 60 periods, single-phase (running off town supply), which I use to drive a couple of lathes and other small machines. This motor has been running for about eighteen months, and has given me every satisfaction, but on starting up on Saturday last I was surprised to find the direction of rotation was reversed.

The motor or connections had not been touch in any way. I will be obliged if you can find room in your valuable paper for this letter, as I have asked several electrical engineers, and none of them are able to give a satisfactory explanation.

**Puzzled.**

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**Australia.**—A decision has recently been given by the Australian Customs authorities to the effect that "relay instruments, time elements, used in connection with electrical circuit-breakers, but are separate and distinct from them," are dutiable at the rate of 17½ per cent. in the case of foreign productions, those of British manufacture being admitted at 10 per cent. *ad valorem*.

## PROCEEDINGS OF INSTITUTIONS.

### Steam Turbines.

By Gerald Stoney, B.E., M.Inst.C.E., M.I.E E.

(*Abstract of* Cantor Lectures *delivered before the* Society of Arts, *March and April*, 1909.)

It has been found that in the reciprocating engine there is little use, considering the temperature at which the feed water is returned to the boiler, in going to a better vacuum than 25 in. With the steam turbine, vacua of 28½ in. or 29 in., or absolute pressures of from ¾ to ½ lb. per sq. in., can be easily utilised, as the difficulty of dealing with large volumes of steam does not occur in the case of the steam turbine as in the case of the reciprocating engine, and it has been found that with the steam turbine the gain due to vacuum goes steadily on up to the highest attainable vacua. Between 25 in. and 26 in., or 26 in. and 27 in., there is a gain of about 4 per cent.; a further gain of 5 per cent. is made with the vacuum increased to 28 in., and a still further gain of 6 to 7 per cent. when it is increased to 29 in.

This is more easily understood if we consider that the theoretical power to be derived from the steam is almost proportional to the logarithm of the expansions, and thus practically the same power can be obtained working from 400 lb. to 1 lb. absolute, or 28-in. vacuum, as from 200 lb. to ½ lb., or 29-in. vacuum. In each case there are 400 expansions by pressure, and in each case the theoretical consumption of steam by Clausius' cycle would be about 9·3 lb. per kw.-hour. With 150° F. superheat this would come down to 8·7 lb., and under the conditions of 200 lb. pressure and 29-in. vacuum with 150° F. superheat, 13·2 lb. per kw.-hour has actually been obtained with an overall efficiency, including the alternator, of about 66 per cent., or 71½ per cent. on the turbine shaft, allowing for the electrical losses. Prof. Ewing, in his book on "The Steam Engine," gives a list of principal results obtained from condensing reciprocating engines, and in no case does the ratio of the consumption of steam by Clausius' cycle, compared with that used per indicated horse-power, exceed 64 per cent. As the ratio of brake horse-power to indicated horse-power is never more than 90 per cent., this means an efficiency at the engine shaft of not more than 58 per cent. When it is remembered that the figure obtained in the case of the turbine was 71 per cent., and further that the reciprocating engine is unable to take advantage of high vacua, it is easily seen where the advantage of the turbine, especially in large sizes, comes in.

In all machinery with reciprocating parts, heavy foundations are required, and in many cases the trouble due to vibration is considerable, especially in the case of quick-running engines. Besides that, especially in large turbines, the cost of repairs and attendance is much less, while the space occupied is only about one-third or one-quarter of that required for reciprocating engines. In very large sizes it has been found practically impossible to make reciprocating engines satisfactory, and it may not, perhaps, be generally known that one of the reasons which led the Cunard Committee to adopt turbines for the great express steamers *Lusitania* and *Mauretania* was the fact that the engineering difficulties of the enormous reciprocating engines required, made the problem almost impossible of solution without the use of turbines.

The arrangement universally adopted for all large turbines is one in which the expansion of the steam is carried out in stages. If the expansion is divided up into a number of steps the velocity of the steam is greatly reduced, and thus not only can the surface velocity of the turbine wheels be reduced but also the speed of revolution, and cutting action of the steam is prevented, for high velocity steam jets are able to cut away the hardest steel. Even yet in some classes of turbines with few stages there is still cutting action on the blades.

The compound turbine naturally divides itself into two subclasses, those in which the expansion of the steam takes place both in the fixed and moving blades, and those in which it takes place in the fixed blades only. Included in the former class is the Parsons, while the latter contains the Rateau, Zoelly, Curtis, and various others. In the Rateau and Zoelly, which strongly resemble one another, the velocity of the steam at each stage is taken up by a single row of blades mounted on a wheel, and in the Curtis by a wheel having two or more rows of moving blades with guide blades between. There are also various combinations of these, especially those with a Curtis high pressure part and a Parsons low pressure, but as yet they have not come largely into use.

Within the last 12 years the output of the Parsons steam turbine has gone up by leaps and bounds, until there are now on land about 2,500,000 h.p. of the Parsons steam turbine at work and on order. Practically the whole of the great power distribution scheme in the North-east of England, at Newcastle, is supplied with these steam turbines. This not only supplies electricity for lighting to the district around Newcastle, but also the whole of the power to many works, shipyards and factories, besides the electrification of the Tynemouth lines of the North-Eastern Railway. In the power stations supplying that district, there are erected—besides smaller ones—eight turbines of 5,000 kw. each, the latter only taking 13·2 lb. of steam per kw.-hour at full load.

In the Rateau and Zoelly type of turbine (which have been developed chiefly on the Continent) unlike the Parsons, in which expansion takes place both in the fixed and moving blades, the whole of the expansion is in the fixed blades, the moving ones being cup-shaped so as to turn the steam and make it give up its energy without altering its velocity while passing through them. The fixed blades are in a series of diaphragms in a cylinder, with a shaft passing through holes at their centre, which shaft carries a series of disks having cup-shaped blades on their circumference. Where the shaft passes through the diaphragms there are suitable glands so as to minimise the leakage of steam as much as possible; and, in order to get a good height of blade, the fixed or guide blades, especially at the high pressure end, only extend to a portion of the circumference. As a rule, all the disks are approximately of the same diameter, expansion of the steam being allowed for by both increasing the height of blade and also increasing the widths of the sectors of blades admitting to the revolving disks.

The Curtis turbine, which was originated in America, is of a similar construction of diaphragms, carrying sectors of fixed blades with revolving disks between, but these disks carry, instead of one row of blades, two, three, and sometimes four rows with fixed blades between, each row taking up a portion of the velocity of the steam and delivering it to the next row of guide blades at reduced velocity; and when its energy has become exhausted, it is delivered to the next diaphragm, where the drop of pressure enables it again to act on another set of moving and guide blades, and so on until the exhaust is reached.

And now as to the theoretical aspects of the question. Some 60 to 70 years ago the thermo-dynamic theory of steam was worked out by Carnot, Regnault, Clausius, Rankine, Kelvin, and others, and it was shown that under given conditions of superheat, steam pressure, and vacuum, it was not possible to get more than the amount of power out of the steam as expressed by the cycle which was worked out almost simultaneously by Rankine and Clausius. It is, then, the object of the turbine designer to obtain a result as close as possible to the result which should be obtained according to the above cycle. In this connection it is necessary to have the velocity of the steam passing through the blades the best in relation to the velocity of the blades, and experience has shown that in the Parsons type of turbine this is best when the velocity of the steam is somewhere about double the velocity of the blades, and in the Rateau a little over one-third.

Now the velocity of the steam depends on the drop in pressure between one row of blades and the next, and it can be shown that $v^2 = 2\,g\,\text{H}\,\frac{d\,p}{p}$ where $g$ = gravity, H is the homogeneous head of steam, which is about 63,000 ft. for high-pressure steam and about 45,000 ft. for steam at atmospheric pressure, $p$ is the absolute pressure at any row of blades, and $d\,p$ is the drop of pressure between one row of blades and the next, and therefore $\frac{d\,p}{p}$ is the amount of expansion that takes place in any row of blades.

Take, as an example, a Parsons turbine, as shown in fig. 1, which is the blading diagram for a 500-kw. turbine for 3,000 r.p.m., and 150 lb. pressure, with a vacuum of 28 in. If we assume that the turbine is of the same diameter throughout, it is easily seen that since the speed of the blades is constant, in order to make the velocity ratio between the steam and the blades constant, the velocity of the steam through the blades must be constant, and as the steam at each row expands by the amount $\frac{d\,p}{p}$, it is evident that each row must have larger openings than the one before by the amount $\frac{d\,p}{p}$, and also that this ratio $\frac{d\,p}{p}$ is a constant throughout the turbine on the assumption that H is constant, which is approximately the case, and for a preliminary consideration may be assumed.

From the equation $v^2 = 2\,g\,\text{H}\,\frac{d\,p}{p}$ the velocity of the steam can be calculated at any point along the turbine, and from this and the area through the blades the quantity of steam used per hour can be calculated. In taking the area of the blades it is necessary, not only to take the actual area through the blades, but also that of the clearance space above them, and further to the quantity thus calculated there has to be added the leakage through the dummies, and also, if steam packed glands are used, the quantity of steam required to pack these glands.

Both these items, especially the latter, are small ones, but when all these allowances are made it is found that within errors of observation the quantity of steam used by a turbine is the calculated one. It is thus easy to calculate the quantity of steam used by a turbine, but the horse-power it will produce is another question, and in many cases, especially in new types or sizes of turbine where the steam consumption per kilowatt-hour was uncertain and a considerable margin was left, it was found that the steam pressures required to give the rated output were considerably lower than was anticipated.

The fact that the steam consumption of a turbine so nearly agrees with theory proves that the velocity of steam through the blades must very closely approach the theoretical, and in fact, unless this was the case, it would be impossible to get from turbines the high efficiencies that are obtained. We, therefore, have a turbine consisting of a drum with blades gradually increasing in height according to what is known as a logarithmic law, that is, each row of blades is $\frac{d\,p}{p}$ higher than the preceding one.

Now since, in an ordinary turbine working from, say, 150 lb. steam pressure down to a pressure of 1 lb. absolute, or a vacuum of 28 in., there are about 150 expansions by pressure—or, say, 100 expansions by volume—we require the blades at the low pressure end 100 times as long as the high pressure end, so that it will easily be seen that the blades at the low pressure end would be so long as to be impossible to put on the spindle. The device, therefore, is adopted of increasing the diameter towards the low pressure end (see fig. 1), and, since an increase of diameter also increases not only

the circumference but also the velocity of the blades, it is easily seen that the height of blade will vary inversely as the square of the diameter; that is, if you double the diameter, you double the velocity of the blades, therefore you double the velocity of the steam, so that you require only half the area through the blades, but since the circumference is doubled you only require blades of one quarter the height. The usual custom in land turbines is to have three drums each $\sqrt{2}$ or 1·4 times the diameter of the next one, and thus the blades on the second drum are half the height they would be if on the diameter of the first drum, and

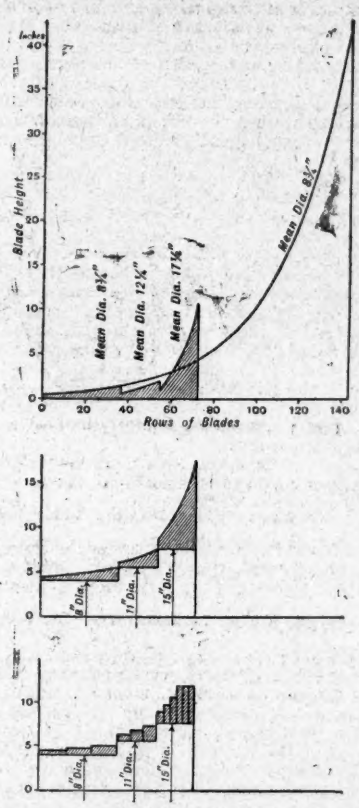


Fig. 1.—Blading Diagram of 500-kw. Turbine, 3,000 r.p.m.

the blades on the last drum, one-quarter the height they would have been if on the diameter of the first drum. This, in the case mentioned above, where there are 100 expansions by volume, reduces the ratio of blade heights from 100 to 25, and by making the blades at the exhaust end of larger opening, so that they have double the capacity for steam of the ordinary blades, the ratio of blade heights is further reduced down to 12½, and this is a very common ratio between the blades at the high pressure and the blades at the low pressure end in ordinary land turbines.

The three drums of the turbine are so proportioned that about a quarter of the power is in the first, a quarter is in the second, and half in the third, but this is purely an arbitrary division, and can be varied within wide limits to any extent desired, but in practice it comes out as a very fair compromise between the various conflicting conditions that have to be considered. Small diameters are an advantage, because you get longer blades, but, on the other hand, as we have shown before, the height of the blade varies inversely as the square of the diameter, and it must be further remembered that the number of rows required for a definite expansion also varies inversely as the square of the diameter, and therefore with small diameters you get great length of drum and long blades, and with larger diameters you get short drums and short blades. The first gives you a turbine shaft of great length which is liable to bend and whip, and, therefore, the clearance over the tops of the blades has to be increased: the latter gives you very short blades, and on account of their shortness the percentage loss by leakage over the top of the blades is large, and the best result is obtained by a happy compromise between the various conflicting conditions. In this relation it is easily seen that for any given number of expansions and revolutions, to obtain a given velocity ratio a certain volume of spindle is necessary, or generally a more convenient way of expressing it is that the product of the number of rows multiplied by the square of the blade velocity gives a constant which, for any given number of expansions gives a certain velocity ratio between the blades and the steam, which may be from 0·4 to 0·6.

The above theory is on the assumption that H is constant, that is, that steam is a perfect gas, which, of course, is not quite true, and therefore, in order to attain accuracy, corrections have to be made for the difference between steam and perfect gas, but these being of a secondary order, they are, as a rule, most easily made by considering H to be constant for various portions of a turbine separately.

In the above turbine, as I have shown, the theoretical curve for the blades is a logarithmic one, but it is almost impossible in practice to make a spindle and cylinder of logarithmic curves, and therefore the device is adopted of stepping the turbine, and, as shown in fig. 1, the blades are stepped so as to approximate closely to a logarithmic curve, each step being made so small that there is no appreciable loss of efficiency due to the varying velocity ratios along the step. Another method of calculating turbines is by the entrophy diagram or $\theta\phi$ method, and this leads to exactly the same results as the method using H, or the homogeneous head of steam, which is given above. Some designers prefer one method, and some the other, but, personally, I have always preferred what may be called the H method.

Other types of turbines such as the Zoelly, Rateau and Curtis, can be calculated in the same way, but the velocity ratios to give the best results are different for them, and each type of turbine has to be considered separately on its own merits. In turbines, it is easily seen that, for a given size, the lower limit of speed is one in which the blades become so short as to cause excessive leakage, and thus loss of efficiency. On the other hand, the upper limit of speed is one in which it is impossible to get sufficient area through the low pressure blades to give good results, since it is not allowable to stress the drum or disk to which the blades are fastened beyond a certain point, and therefore the surface speed is fixed, and it is also necessary not to stress the blades beyond a certain point, and therefore the maximum height of the blade on the drum or disk is also fixed.

Another thing is that it is not advisable to have the height of blades more than one-fifth to one-quarter of the diameter of the drum to which they are fixed, as otherwise they spread so much at the tips as to become a bad shape.

With these limitations, it can be shown that turbines can be constructed of similar dimensions to run at speeds the inverse of those dimensions. Thus, if we take a 1,000-kw. turbine, running at 3,000 r.p.m., and double the size of it all over, the surface speeds will be the same at 1,000 r.p.m., and the stresses on the material of the blades, drum, &c., will be the same. On the other hand, we have double the diameter and double the height of blade, and therefore four times the area for the steam to pass through, with the blades moving at the same velocity, and, as a result, four times the power will be obtained, or our turbine at 1,500 revolutions will give an output of 4,000 kw. This gives the limiting speed for any given turbine, but except in exhaust turbines, which work with steam at atmospheric pressure, and therefore have to deal with great volumes, and also turbine-driven blowers which run at an average of about one and a-half times the speed of turbines driving alternators and dynamos for similar outputs, this limit is rarely attained.

Now it can be shown that alternators also obey the same rule of varying inversely as the square of the speed, and thus it will be seen that alternators coupled to turbines go up in size together, and that apart from the trouble there is due to being compelled to have an even number of poles, alternators of the maximum size for that speed have similar turbines attached to them. For instance, as above, a 1,000-kw. turbine attached to a 1,000-kw. alternator at 3,000 r.p.m. will have similar properties and characteristics to that of a 4,000-kw. turbine attached to a 4,000-kw, alternator at 1,500 r.p.m., and thus there is no limit to the size of turbo-alternator. In the case, however, of continuous current dynamos, the output of a dynamo (as it is chiefly limited by commutation conditions which depend principally on the ampere-turns on the armature per inch diameter) is practically only proportional to the speed, and it is easily seen that a limit is soon reached where the speed of the turbine is too low for economical conditions.

This statement that the output of a dynamo varies inversely as the speed is not exactly true, the real ratio in practice being as the 1¼ power of the speed, but still a limit is soon reached for continuous current work, and although we can make a 1,000-kw. alternator running at 3,000 r.p.m. we can only make a 500-kw. continuous current dynamo to run at the same speed, or a 1,200-kw. to run at 1,500 r.p.m. The 500-kw. at 3,000 r.p.m. is a very good machine, and so is the latter, but this is about the lowest speed at which a turbine can economically run at that size, and thus no one has put more than about 1,200 or 1,500 kw. into one dynamo. However, by using tandem dynamos it will be seen that the output is doubled, and this enables tandem turbo-dynamos up to about 4,000 kw. to be economically built.

In the design of marine turbines the same lines are followed exactly as in the design of land turbines, but in marine turbines the limitations of the screw propeller are to be dealt with instead of the limitations of dynamos, alternators, &c., in land work, and the importance of carefully balancing the efficiency of the propeller against the efficiency of the turbine has to be most fully considered. Screw propellers, as a rule, are more efficient the slower they go, turbines are less efficient the slower they go, and therefore the balance between the two has to be most carefully looked into. As a result it has been found that with simple installations of screw propellers and turbines it is not advisable to go below a speed of 15 to 18 knots.

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**Electrical Matters at Newport (Mon.).**—The Electricity and Tramways Committee has recommended the T.C. to appoint Mr. C. P. Sparks (not Parkes as mentioned in error on p. 543), at a fee of 250 guineas, plus travelling and out of pocket expenses, to report upon the question of tariff so that the modifications can take effect as soon as possible, and as to whether the undertaking is being worked to the best advantage.

## £6,318.

In view of the great interest that was taken in the Manchester Electrical Exhibition which, at this period last year, was giving so excellent an education to the thousands of that district, and was keeping us all engaged at such high pressure, we believe that the balance-sheet, given below, will be studied with no little interest. It will be observed that there was a net profit of £6,318. Twenty per cent. of this sum was returned to the exhibitors, and 10 per cent. to the donors, leaving £740, which was distributed among various charities as shown, about one-half going to the Electrical Trades Benevolent Institution. The Committee and others who were responsible for the success of the Exhibition—not excluding the electrical Press which played no little part in ensuring the above result—are to be congratulated on the financial outcome of the biggest exhibition effort that the British electrical trade has ever made.

### Receipts.

| | |
|---|---|
| To Space account—exhibitors ... ... ... ... | £10,061 |
| „ Donations—Corporations ... ... ... ... ... | 1,133 |
| „ Gate money and tickets ... ... ... ... ... | 4,751 |
| „ Advertisements, catalogues, programmes and postcards | 823 |
| „ Sundry profits:— | |
| Lavatories, cloakrooms and side-shows ... ... | 252 |
| „ Electric current and meters ... ... ... ... | 930 |
| „ Gas and water ... ... ... ... ... ... | 82 |
| „ Commission on refreshments ... ... ... ... | 1,033 |
| „ Commission on stand fittings ... ... ... ... | 282 |
| „ Bank interest ... ... ... ... ... ... | 46 |
| | £19,393 |

### Expenditure.

| | | |
|---|---|---|
| By cost of buildings ... ... ... ... | | £4,031 |
| „ Manchester Corporation:—For re-turfing, roadway, drainage, sewerage, and Poor Rate ... ... ... ... ... | | 908 |
| „ Advertising:—Posters and bill posting ... | £409 | |
| Electrical Press and Daily Press ... | 729 | |
| Post Office and other exhibits ... ... | 78 | |
| | | 1,216 |
| „ Entertainments:—Bands ... ... ... | £666 | |
| Luncheons, Press and opening ceremony ... ... ... ... | 272 | |
| | | 938 |
| Decorations ... ... ... ... | | 262 |
| „ Lighting:—Fittings, wiring and lamps ... | £424 | |
| Electric current and meter hire ... | 693 | |
| | | 1,117 |
| „ Gas, water and mains ... ... ... | | 189 |
| „ Police and Fire Brigade ... ... ... | | 265 |
| „ Insurances ... ... ... ... | | 122 |
| „ Licences and legal charges... ... ... | | 115 |
| „ Architect's and accountant's fees, &c. ... | | 126 |
| „ Allowance gratuitous services ... ... | | 311 |
| „ Stationery and printing catalogues ... | | 595 |
| „ Management, travelling and preliminary expenses ... ... ... ... ... | | 1,546 |
| „ Office expenses, wages, postage, &c. ... | | 1,268 |
| „ Special rebate to members N.E.M.A. ... | | 66 |
| „ Balance profit distributed thus:—Rebate to exhibitors, 20 per cent. on space money ... ... ... ... ... | £1,989 | |
| Rebate to donators, 10 per cent. on donations ... ... ... ... | 113 | |
| International Trade Exhibitions, Ltd., 45 per cent. on profits as per agreement ... ... ... ... ... | 2,843 | |
| C. S. Northcote and W. Davenport, 10 per cent. on profits as per agreement ... ... ... ... ... | 632 | |
| „ Benevolence:—East Lancashire Systematic and Benevolent Institution ... | 10 | |
| Electrical Trades Benevolent Institution ... ... ... ... ... | 365 | |
| Manchester Royal Infirmary ... ... | 146 | |
| Ancoats Infirmary ... ... ... | 109 | |
| Salford Royal Hospital ... ... | 109 | |
| | | 6,318 |
| | | £19,393 |

Audited and found correct,

Edwin Guthrie & Co., *Chartered Accountants.*

10, Tokenhouse Yard, London, E.C.,
*September 21st*, 1909.

## NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

### Hand-Shield Wall Plug.

The use of the ordinary type of wall plug is attended with some danger, due to the flexible passing through the hand of the user, and its liability to fray and short-circuit on the edge of the hole from which it hangs. To remove these drawbacks, the British Central Electrical Co., of 17, Hatton Garden, E.C., have brought out a "Handshield" wall plug, as illustrated herewith; this, it will

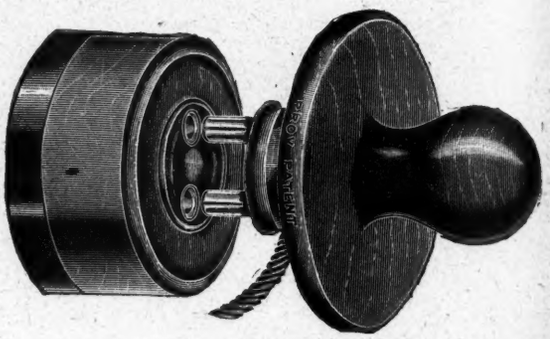

Fig. 1.—Hand-Shield Wall Plug.

be seen, provides complete protection to the user, and as the flexible hangs out of a vertical hole, it is not subject to the deleterious bending met with in the ordinary type. The plug is made with either two or three pins, in two sizes for 5 and 15 amperes respectively, and is very neat and handy to use. It complies with the recommendations of the Home Office.

### Two-Speed "Cascade" Motors.

The Sandycroft Foundry Co., Ltd., of Chester, have brought out a two-speed "Cascade" motor, generally similar in construction to the one-speed machine, except that slip-rings are provided. The stator windings carry only primary currents when the machine is running at the higher speed. When running at the lower speed they carry in addition the secondary currents induced by the action of the second rotor field. The rotor winding is of the plain barrel type, exactly similar to those of ordinary slip-ring machines, the only difference being in the method of connection. The windings form a closed circuit, as in the one-speed machines, but a certain number of coils are tapped into the closed circuit and provided at their free ends with slip-rings. The arrangement of the windings is such that when the slip-rings are short-circuited the current induced in the rotor gives only one number of poles, and the machine under these circumstances behaves exactly like an ordinary slip-ring motor. When the slip-rings are open-circuited a small number of the rotor conductors become inoperative, and the currents in the rotor then produce two numbers of poles, the second of which acts upon the stator and causes the motor to run at "Cascade" speed. As an example, a machine wound to run at 8-pole and 12-pole speed carries 8-pole windings. To start such a machine a starting switch, connected to the slip-rings in the ordinary manner, is gradually short-circuited; the machine then behaves in every way as an ordinary slip-ring motor. When it is necessary to reduce the speed, the slip-rings are open-circuited and the short-circuiting switch mounted on the side of the motor and connected to the stator windings is closed. The rotor now re-acts upon the stator, and the machine runs at "Cascade" or 12-pole speed. The operation is reversed when it is required to raise the speed from the lower to the higher one. Whilst the machine is slowing down at "Cascade" speed it is acting as a generator and returning energy to the line.

It will be noticed that with these machines it is never necessary to break the main circuit, so that the whole of the operations can be brought about without any sparking. This method of control is suitable for motors required to run for long periods at two definite speeds, and we are informed that it has been very successfully applied to the driving of air compressors, ventilating fans, mortar mills, pumps, &c. There is a large field for two-speed motors for driving such classes of machinery as winding engines and rolling mills; in these cases, instead of mounting a short-circuiting switch on the side of the machine, a controller is connected with the tappings. When starting, the stator controller is first brought into operation, and the machine is speeded up to "Cascade" speed under these conditions; the slip-ring controller is now brought into operation, and the machine then runs up to the higher speed. The method of operation is exceedingly simple, and the acceleration losses are very considerably reduced. There is a further advantage in the application of these machines for such work, as when starting in "Cascade" they are capable of exerting a larger starting torque than when operating on the slip-rings. For a given input the motor at "Cascade" speed develops 40 to 50 per cent. more torque than when running on the slip-rings. The most economical method of operating the winding engine is, therefore, to start with the maximum amount of power required during the winding, and to

run up to speed with high acceleration up to the two-thirds speed. Above this speed the slip-ring controller comes into operation, and for the same power input the acceleration is reduced. With this system of control the efficiency of electric winders is high, and important advantages without complications are claimed for it.

The cost of a two-speed winding motor is but little in excess of that of an ordinary one-speed slip-ring machine, and the further additional cost is only that of the stator controlling gear. As the amount of energy to be dissipated in resistance is only about half as much as with single-speed machines, the sizes of the controlling resistances are much reduced. In the whole operation of winding and changing speeds the main circuit of the machine is never open-circuited.

### Tell-Tale for Collieries.

The accompanying illustration shows a "tell-tale" invented and made by Messrs. Imeson, Finch & Co., Ltd., of Bridge Works, Stockton-on-Tees, to indicate the number and identity of men in a pit. It consists of a series of numbered swing brass checks, each held in the "out" position by a swivel pin, bearing the corresponding number. Each man, as he receives his lamp, withdraws the pin

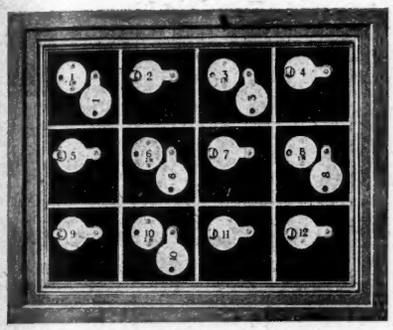

Fig. 2.—Imeson's "Tell-Tale" for Collieries.

bearing his number, and attaches it to his lamp, the check at the same time dropping to the "in" position. No person is allowed to enter the mine without the swivel clip attached to his lamp. On leaving the pit, he detaches the clip and pins his check in the "out" position again. The lamps need not be numbered. The device is simple, cheap and effective.

### Willans-Victoria Turbo-Pump.

Messrs. Willans & Robinson, Ltd., of Rugby, are placing on the market a new turbo-pump for both high and low lifts, designed on lines which enable it to be manufactured cheaply and accurately

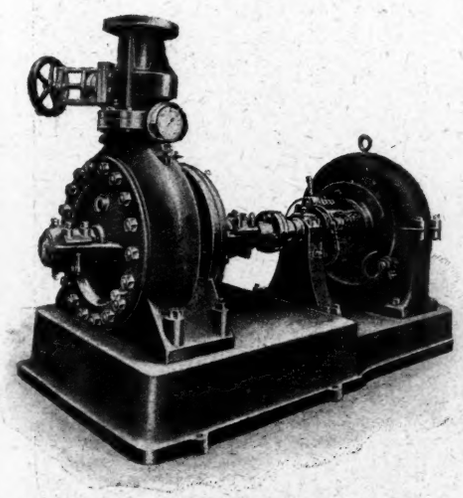

Fig 3.—Willans-Victoria Turbo-Pump coupled to Electric Motor.

to gauge in standard sizes. The high-lift pumps will deal with heads up to 2,000 ft., and the low-lift ones up to 50 or 60 ft. Fig. 3 shows one of these pumps coupled direct to an electric motor, and fig. 4 is a sectional view of the pump. A noteworthy feature is the absence of a stuffing box at the delivery end, as only low pressure exists in the end chamber. Thus much wear and friction has been obviated, to say nothing of the saving of trouble and annoyance. At the suction end the stuffing-box is water-sealed, and the gland need not be screwed hard up, as the box has to hold against only $\frac{1}{10}$ atmosphere. There is no thrust bearing at all, as end thrust has been abolished by means of a patent device which automatically adjusts itself for changes of output and head while the pump is running, and for wear in the impellers. The bearings are separated from the packing by a gap of an inch or two, so that mud or grit cannot enter them. They are cast in one piece with the end covers, ensuring permanent alignment, and are provided with ring lubrication. In the case of sinking pumps, forced lubrication is fitted.

From the drawing, fig. 4, it will be seen that the pump is not built up of sections, one for each stage; the central casing is of cylindrical bore, and the guide wheels and diaphragms fit accurately into it, so that dismantling and reassembling is extremely easy, and

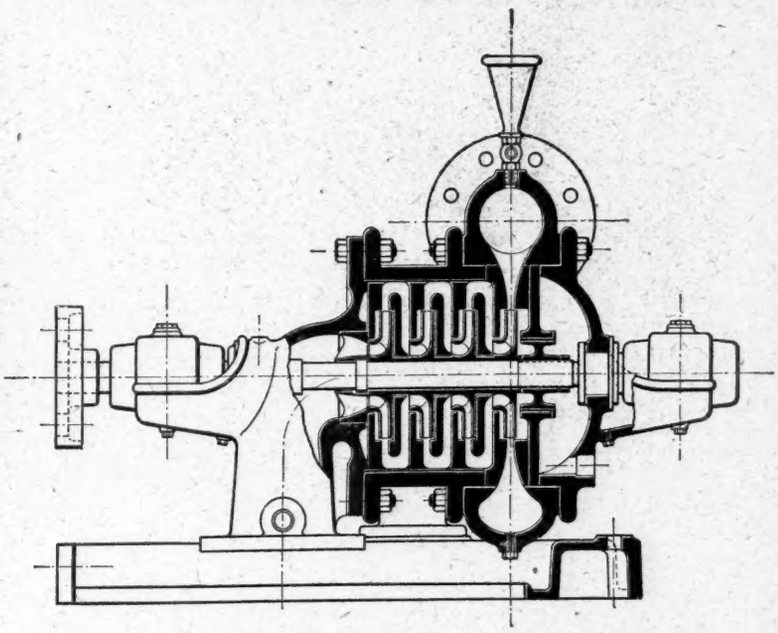

Fig. 4.—Section of Willans-Victoria Turbo-Pump.

true alignment is ensured. The impellers and guide wheels are all made of special bronze, and the inner surfaces of the impeller and guide wheel channels are finished throughout, so that the water never comes in contact with a rough surface; this, as experience has shown, materially increases the life of the parts. The central casing is lined with special bronze. We are informed that high efficiencies are being obtained with these pumps, which are built to the designs of Mr. J. Orten-Böving.

### New Gauges.

An extremely neat system of gauges has been brought out under "Windley's Patent" by the Crown Works, Chelmsford. It consists of a set of hardened steel blocks of standard dimensions, which are employed in conjunction with an outside caliper and an

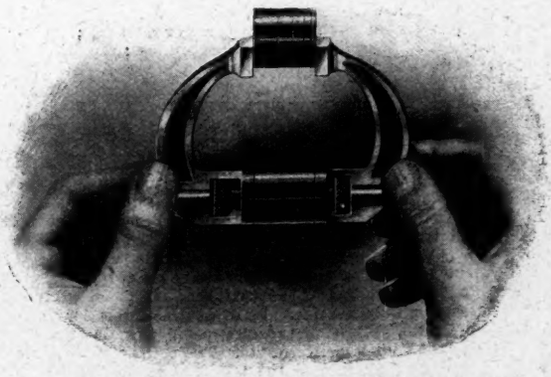

Fig. 5.—Testing the Accuracy of the Gauges.

inside gauge, the whole outfit being mounted in a neat pocket case as shown in fig. 6. The blocks, which, like the holders, are beautiful specimens of British workmanship of the highest class, are seven

in number, varying from $\frac{1}{16}$ to 1 in., and give, with the outside holder, a range from $\frac{1}{16}$ to $2\frac{1}{2}$ in. by steps of $\frac{1}{16}$ in., or 40 sizes; with the inside holder the range is from $2\frac{1}{2}$ to 4 in., 22 sizes, and in addition the blocks themselves give 40 end-measuring sizes singly and in combination.

When "wrung" together, by sliding one over the other under firm pressure, the blocks adhere to one another with remarkable tenacity; they can equally well be "wrung" together with one arm of the external holder, when they form a convenient height gauge, for use in combination with a surface plate. An important feature of the system is the self-checking characteristic of the device; as

Fig. 6.—Windley's Patent Gauges.

shown in fig. 5, five of the blocks wrung together are being tested against the 1-in. block in the holder, and a crucial test consists in afterwards interchanging the two; unless the gauge is perfect, it will not pass this test. The internal holder can similarly be tested with the external calipers. A set of these gauges was reported on by the National Physical Laboratory recently; no error in length as great as 0·00001 in. was found, and the end faces were reported to be parallel within that amount.

The blocks are readily inserted in the holders by a quick-grip lock-nut device, and the combination gives a handy set equivalent to over 100 separate standard gauges with, of course, a great economy in cost. We have examined a set, and greatly admire the excellence of their finish and the accuracy of their dimensions.

## The Thorpe Electrolytic Watt-hour-Meter.

Undeterred by the apparently insurmountable difficulties in the way of constructing a shunted electrolytic meter of the gas voltameter type, the inventor of the Thorpe meter has for two years been experimenting with the view of devising such a meter. He now claims that he has succeeded, not only in constructing a shunted meter, but in making a watt-hour-meter on this principle. The materials appear so unpromising as to be absolutely forbidding, but the inventor states that his meter will register the smallest current passing, and that the drop at full load is not more than one volt; that it is a watt-hour-meter, with a dial like an ordinary motor meter, and does not require refilling or resetting; that no chemicals are used that are likely to give trouble; that there is no temperature error; that the meter has a practically straight-line law; and that it is cheap to manufacture. We have inspected the meter at work, and as it will be on view at the Shoreditch Exhibition, which opens on Monday next, anyone else can do likewise.

Fig. 8 shows the interior of the meter; the electrolytic cell is seen on the right, and consists of a glass bulb attached to a capillary U-tube, the former containing a weak solution of caustic soda and the latter mercury. Nickel electrodes convey the current to the liquid in the bulb, and as the gases evolved collect in the bulb, the mercury is slowly forced up the other leg until it makes a contact and actuates an electromagnet; the latter registers on a dial and recording train, and the extra current passing through the electrolyte fires the mixed gases as the liquid leaves the kathode point, thus releasing the electromagnet and at the same time refilling the bulb with electrolyte. The bulb at the other end of the U-tube is sealed, so that the temperature and pressure of the atmosphere have no effect on the records.

The trouble due to the back E.M.F. of the electrolytic cell is overcome by a novel device called an "absorption cell," which is a test tube containing two plates of nickel having a surface of 160 mm.$^2$, in a 20 per cent. solution of caustic soda. This cell, which is seen on the left hand of the figure, never requires refilling, as no gas is generated in it; it is connected, as shown in the accompanying diagram (fig. 9) at A, in parallel with a resistance R, which is the only resistance that requires adjusting—a very easy matter. "The function of this cell is to make the meter a watt-meter." In other words, the effect of the combination is that the rate of evolution of gas in the electrolytic cell E is proportional, not to the current passing in the main circuit, nor to the voltage of supply, but to the product of these two quantities. We have not

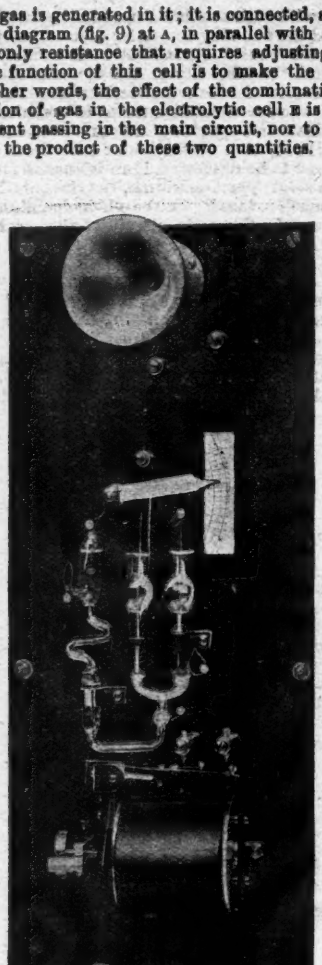

Fig. 7.—Thorpe Time-Limit.

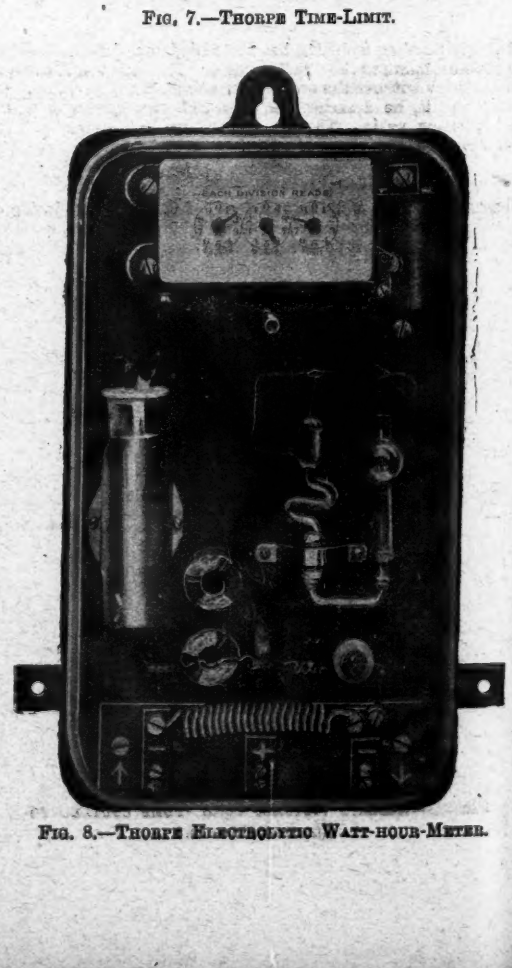


Fig. 8.—Thorpe Electrolytic Watt-hour-Meter.

yet understood precisely how or why this comes about, but we are assured that it is so in practice, within a range of voltage of 20 per cent. above or below normal. The main current passes through the shunt S, producing at full load a drop of ¼ volt in the case of the D type, and ½ to 1 volt in the case of the A type of meter. The current through the electrolytic cell is extremely small, the resistance r being of the order 4,000 ohms, and on open circuit, though a very small current necessarily flows, there is no "creeping," as the gases evolved recombine, without, therefore, actuating the recording mechanism.

A somewhat similar meter is made without a dial, a thermometer scale reading to ¼ unit being substituted; this is made for two ranges up to 250 and to 1,000 units respectively. This meter can be reset by means of a key, which fires the gases and restores the reading to zero, without opening the case.

The essential device of the Thorpe meter has been applied also to a time limit for a circuit-breaker, as shown in fig. 7. The coil at the bottom of the figure carries the main current, and on the occurrence of an overload attracts an armature, which closes a circuit through the electrolytic cell on the left-hand and the lamp at

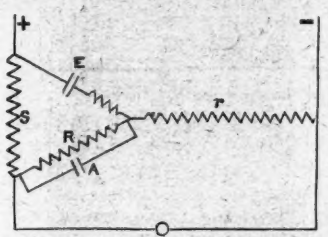


Fig. 9.—Diagram of Connections.

the top of the figure. It also closes a circuit leading through one leg of the double U-tube to a tripping coil on the circuit-breaker, but this is open at the contact in the U-tube. As the evolution of gases in the bulb goes on, the mercury is driven up the left-hand tubes, and on reaching the adjustable contact, which is set by the scale shown, closes the circuit to the tripping coil, opening the main switch. The electrolysis continues until the liquid in the bulb leaves the kathode, when a spark occurs and the gases are ignited, resetting the device. Should a temporary overload occur, the armature being released, prevents the trip coil from being energised, but the electrolysis continues until the apparatus resets itself as usual—a matter of only about 20 seconds. The time limit can be set to any value below 20 seconds—in the case of the instrument that we inspected. Lastly, the device has been applied to an automatic motor starter. All these new apparatus will be exhibited at Shoreditch by the Thorpe Meter Syndicate, Ltd., for whom Mr. Haydn Harrison, of 11, Victoria Street, is the sole agent.

## Suterlite Reflectors.

Messrs. Cunnington, Harris & Co., of 21, North Audley Street, W., who have taken over the business of Messrs. Frank Suter & Co. Ltd., have improved the "Suterlite" reflectors, which are now being made in aluminium and lined with opal glass. A special feature claimed for their design is the facility for wiring them with ordinary V.R. wire instead of flexible. The holders are mounted on a carrier A, as shown at B in fig. 11, which can be wired and slid into position in the channelling; the terminals G are slotted in such a way as to prevent any risk of shearing the wire, and it is only necessary to strip the insulation off about ¼ in. of the wire as at I before clamping it in place with a nut H. Instead of the 10-in. "Suterlite" carbon lamp, two of the firm's metallic-filament lamps, with contacts at both ends, can be used, as shown in fig. 10. The reflector can be made continuous by adding as many 12-in. sections as may be desired. Fig. 12 shows a section of the reflector with opal lining; it can also be had of polished aluminium. Fig. 10 shows a piece of the centre strip with the holders and one of the two lamps, which are silvered on the underside.

Fig. 10.—Centre Strip and "Suterlite" Metallic-Filament Lamp.

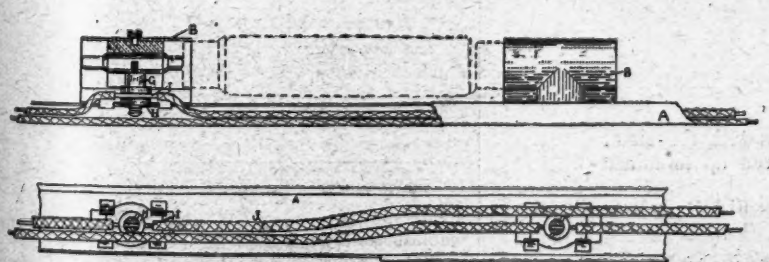

Fig. 11.—Details of "Suterlite" and Wiring.

Fig. 12.—Section of Reflector, showing the Centre-Strip slid into place.

# LEGAL.

### A Pit Repairer's Claim.

A Lochore pit repairer has raised an action in the Sheriff Court, Kirkcaldy, against the Fife Coal Co., for £500 as compensation for injuries received in a pit explosion. Pursuer says he was sent to switch on the current for the ventilation of the seam. Not anticipating any danger, and being ignorant of the dangerous character of the gas with which the seam was impregnated, he did so, and immediately after the starting of the motor a terrific explosion of the inflammable gas took place. Three of the pursuer's fellow-workmen were precipitated down the shaft, and were either instantaneously killed or fatally injured, while the whole of the men in the seam, including the pursuer, were severely burned or otherwise injured. The accident, he contends, was caused through the failure of the defenders to provide a proper system of ventilation. Defenders admitted liability for the accident to the pursuer, and tendered £200 in settlement of the claim. The Sheriff is considering the case.

### Alleged Electrical Defects in Fife Pits.

[*Prosecution by H.M. Inspector.*]

A case of great interest was heard on Thursday last week in the Dunfermline Sheriff Court.

Mr. C. A. Carlow, manager of the Fife Coal Co., was charged with having in Foulford Pit (1) caused or permitted to be used two switches and two fuses which were not sufficient in size and power for the work which they might be called upon to do; (2) caused or permitted to be used in the switch room, without being earthed, a metallic cover provided to prevent accidental contact with live parts; (3) caused or permitted to be used two gate-end or terminal boxes which were not in any way fixed, and of which one was not efficiently earthed, and the other was not earthed at all; (4) caused or permitted the unarmoured conductors or distribution cables in the main haulage road not to be efficiently covered and safeguarded at all parts, and not to be so installed, worked and maintained as to reduce the danger through accidental shock or fire to the minimum; (5) caused or permitted the unarmoured conductors or distribution cables in the main haulage road and in two haulage roads leading to the coal face from the main haulage road to be fixed within reach of injury from passing tubs or trams and not to be protected by a suitable covering, in consequence whereof the installation covering on the conductors was injured by abrasion at parts, and thus created danger through accidental shock or fire in contravention of the Coal Mines Regulation Act, 1887, and the electrical special rules.

Dr. John Ross, on behalf of the Fife Coal Co., said the Inspector having 41 mines to deal with calmly pounced on one pit in which he thought he had found defects, and without further notice this was followed by these proceedings. Accused was asked to do something that was almost impossible, namely, to remove the whole of the company's plant from this date. In regard to another pit at Lumphinnans, the Inspector was asked to state what he was driving at, but he would not come to close quarters and say what he wanted. He would rather lie by, and at a convenient opportunity seize the occasion of finding out some paltry defect. The Inspector knew perfectly well that the Fife Coal Co. were most anxious to use every precaution to preserve the lives and limbs of the men, and in the past they had spared neither trouble nor expense to safeguard the workers. They were anxious to meet the Inspector and see what he wanted, and in certain respects they had met the things he had asked for, but the matter of kindness or courtesy did not come into the case.

Mr. J. S. Soutar, the procurator fiscal, said he did not desire there should be any misunderstanding in regard to the purpose of the prosecution. The Fife Coal Co. controlled a large number of collieries, and employed about 12,000 men out of some 26,000 operating in the county, and it had been determined because of

past experience that this opportunity should be taken of endevouring to stimulate, or perhaps he should say create, a sense of not merely the responsibility incumbent, but the relative duty consequent thereon, upon those who were superior to the certificated managers of the pits. Granted that Mr. Rowan might also be responsible, they might perhaps deal with him later on. They also alleged that Richardson, the certificated manager of the pit, had a statutory duty.

Sheriff Shennan: Apparently that is not disputed, assuming the complaint is relevant.

Mr. Soutar said there was a specific complaint made in April in regard to part of the plant, and the detailed objections were discovered in the end of July.

The Sheriff said he must write a judgment on the relevancy.

Dr. Ross: If you go into electricity we may have to send to the ends of the earth for experts.

Our correspondent reports that his Lordship's decision is anxiously awaited.

## INTERLOCKED MOTOR STARTERS AND SHUNT REGULATORS.

By T. Golding and O. C. Dinerman.

The subject of interlocking motor starters and shunt regulators has received but little attention from contributors to the electrical Press, and, since it is a subject of such vital importance, a short description of some of the methods adopted by leading manufacturers will doubtless prove interesting.

The necessity for effective interlocking is evident, when the dangers of starting up a motor with a weakened field are considered, both from the points of view of the motor and the starting rheostat. Unless some arrangement is provided to ensure a full field at starting, great damage is likely to occur. Not only should the motor be started up with a strong field, but precautions should also be taken to prevent

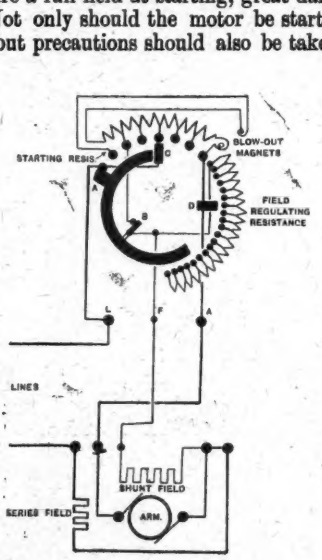


Fig. 1.

resistance being suddenly inserted in series with the shunt field in large steps when the motor has run up to normal speed.

If devices are not provided to meet these ends, and the motor is started up with the field weakened by regulating resistance, the rushes of current in the armature are excessive, owing to the slow increase of back E.M.F. This, consequently, causes disastrous sparking at the commutator, with consequent wear and tear; further, if the motor is not sufficiently fully designed, there is a danger of burning out armature coils. Again, rheostats are designed to start up motors on the assumption that the current rushes will not exceed the normal full load current by more than a certain percentage. Obviously, therefore, if these rushes are much heavier than the specified amount, the resistance may be burnt out as well as bad sparking take place between the brush and the contacts.

Having started up satisfactorily, if a high resistance is suddenly inserted in the field circuit, not only is bad sparking obtained at the commutator, due to the greatly weakened field, but a high E.M.F. of self-induction is produced in the field windings, which may break down the insulation or in other ways cause damage. These effects are both costly and

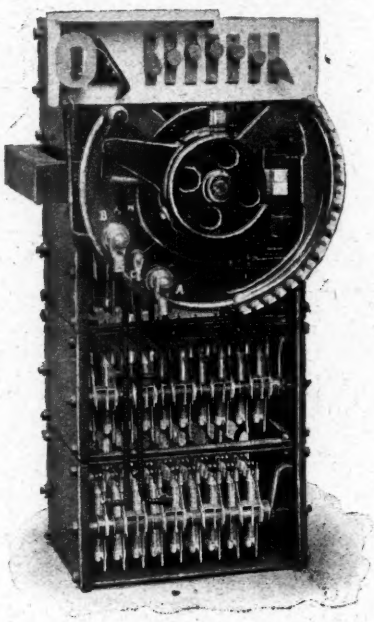

Fig. 2.

annoying, consequently any device which will reduce the danger is exceedingly valuable; and, as in actual practice the addition of suitable apparatus is generally so simple and cheap, it is advisable always to have some interlocking device when starters and shunt regulators are used.

Generally speaking, the devices in practice designed to attain the above ends can be classified under two headings, viz., mechanical and electrical.

Of the mechanical interlocks, perhaps the most simple is the type illustrated in fig. 1. It consists essentially of a series of contacts, some of which are for starting, the remainder being for regulating.

In the example shown, the usual English method of moving brush arm is reversed, the sector being revolved and the brushes remaining stationary.

When the sector is in the position shown, the extension A brushes the first of the fixed contacts, and thus completes the field circuit through the brush B. Further

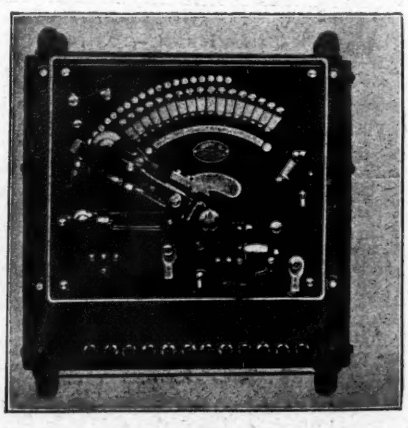

Fig. 3.

movement will bring the sector on to the contact C completing the armature circuit through all the starting resistance. When this has been cut out, the sector short-circuits C and D, and, consequently, all starting resistance, at the same time breaking the field circuit at B, but making it again on the first regulating contact. As the lever is

moved further round, regulating resistance is inserted, and the motor speed is increased.

It will be obvious that before the regulating resistance is inserted, the starting resistance must first be cut out.

This type of apparatus can be fitted with automatic catures, to protect the motor against inequalities of load or

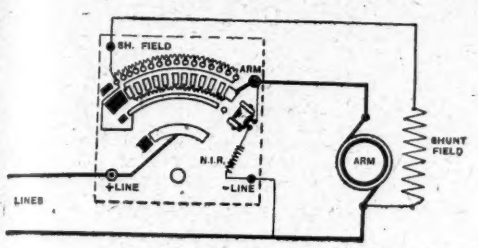


FIG. 4.

supply. The actual apparatus—of which fig. 2 is an external view—is of German manufacture, and is designed for outputs from 1 to 150 B.H.P.

It will be noticed that in the "off" position the shunt field has a discharge path through the armature and start-

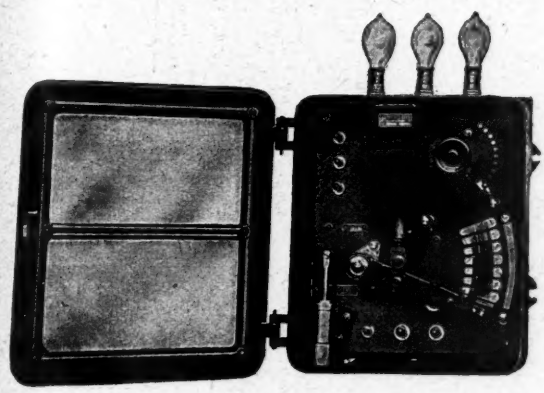

FIG. 5.

ing resistance. This is clearly advantageous in cases where the regulating resistance has a high value.

Whereas in the above case both operations are carried out by the movement of one lever, figs. 3 and 4 illustrate a type in which two separate levers are provided. One lever is for starting only, and on it reaching the "full-in" position

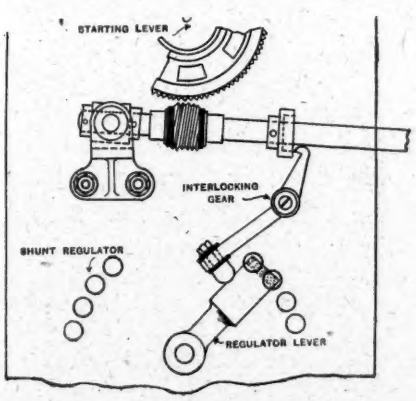


FIG. 6.

and being engaged by the "hold-on" magnet, a projecting piece on the casting engages the trailing lever, moving it to the first of the shunt contacts.

Whilst cutting out the armature resistance the shunt regulating resistance is short-circuited by means of a contact on the leading lever brushing a sector. In the normal running position of the leading lever this short-circuit is removed, and the trailing lever is free for regulating the speed.

Any abnormal condition in the line or load effects the release of the leading arm, which, being controlled by a powerful spring, returns to the "off" position, taking the regulating arm with it.

To illustrate the application of interlocking as applied to automatic motor-starters, fig. 5 is given. This is a most simple case, the regulating resistance being short-circuited (by a brush on the rheostat arm) in a similar manner to that described in reference to figs. 3 and 4, until all starting resistance has been cut out, when the regulating resistance can be inserted for speed variation. It

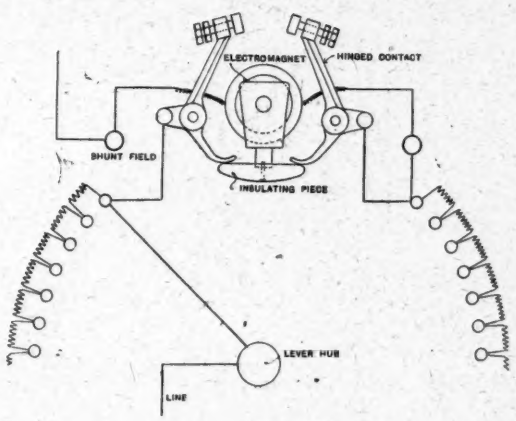


FIG. 7.

will be clearly seen from the illustration that no provision is made to prevent the resistance being introduced in one step, consequently this would not be suitable for a large range of regulation.

Of course, a device could be fitted to ensure the regulating lever being brought back to the "no resistance in" position

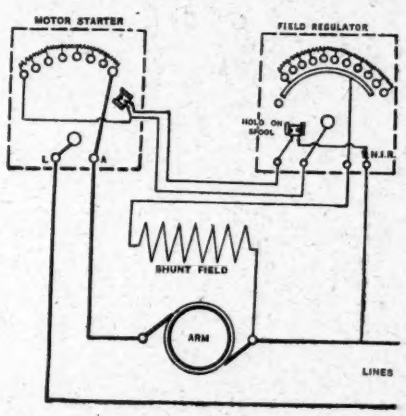


FIG. 8.

before commencing to regulate, but in cases where the regulation to be obtained is sufficient to merit this addition, it is advisable to use a slightly different type of interlock—of the electro-magnetic type, to be described later.

A device which necessitates the use of a link for interlocking purposes only is shown in fig. 6. In this figure the device is shown applied to a starter with worm slow-speed gear. It is, however, also applicable to any form of hand-operated motor-starter. This inter-connecting lever is provided with a hook at one end, which engages a collar on the worm spindle, and does not release it until the regulator lever is in the position when all regulating resistance is out of circuit, in which position the catch is released, leaving the worm free to engage the quadrant, and, consequently, to start up the motor.

In every case described above, it is essential that the regulator and starter are mounted on a common base. This, although in many cases an advantage, may in others be impossible or inconvenient, particularly when the regulation

has to be effected at a distance from the motor. To fit the starter at an equal distance would necessitate the use of unnecessarily long heavy leads.

Interlocking in these cases is attained by the use of electromagnetic devices. Perhaps the neatest form is that shown in fig. 7. The arrangement consists of two hinged contacts tending to always come together, and an electromagnet with a hinged armature, which in the closed position opens the two contacts referred to. The magnet is not sufficiently strong to lift the armature, and the armature can only be lifted by bringing the shunt regulating switch to the first

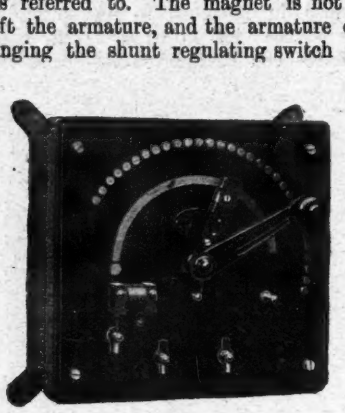

Fig. 9.

stop, where a small projecting piece on the rheostat lever slides against the armature and lifts it into the closed position. The two small contacts previously mentioned entirely short-circuit the shunt-regulating resistance, and, as the electromagnet is connected in the field circuit, whenever this is broken, the resistance is short-circuited quite independently of the position of the switch arm. The motor can be restarted with the shunt-regulator arm in any position, but no shunt resistance can be inserted until the switch arm is brought to the first position, and the small contacts consequently opened.

Another type of this class of interlock is shown in figs. 8 and 9. This is provided with two levers, one of which carries a soft iron armature and a brush which makes contact on the metal sector, unless held over by the "hold-on" magnet, when the contact is removed from the sector and made on a button. The other lever is free to move over the field contacts for regulation. When the former lever brushes the sector, all regulating resistance is short-circuited, the short-circuit not being removed until this has reached the position where it no longer makes contact on the sector. In order to bring it back to here, the other lever has to be brought back to the "all resistance out" position. If the motor has been started up, the magnet will retain the shorter lever—the longer one being free for regulating. Any abnormal conditions arising—such as failure of supply, overloading of motor, &c.—effects the de-energising of the hold-on magnet, allowing a spring in the hub to carry the lever into a position where all resistance is short-circuited.

An exceedingly simple and efficient method of interlock (covered by patents) adapted to a multiple lever type starter, is shown in fig. 10. On the lever of the shunt regulator is cast a fan with notches, which are engaged by a detent, actuated by an electromagnet in series with the shunt field. Unless this magnet is energised, the contact lever is kept at the "all resistance out" position by the aid of a powerful spring.

On the final lever of the starter is fitted a copper brush which bridges two contacts, these being so connected that when in this position the shunt regulator and hold-on coil are short-circuited. When, however, this last lever is closed, and consequently all the starting resistance is out of the motor circuit, the short-circuit is removed, allowing the hold-on coil to be excited, and leaving the regulating resistance available for insertion in the shunt field.

The magnet now being energised, the detent before referred to will hold the contact lever in any position, in which it is placed by hand, corresponding to the speed required. On failure of voltage or any interruption in the motor circuit, the hold-on coil will be de-energised, releasing the contact lever and allowing it to return to the first position, where all resistance is out.

In cases where the variation of shunt current necessary to give the required increase of speed is too great to allow the hold-on coils mentioned above to be connected in series with the shunt field, it is usual to connect them in series with a high resistance unit across the lines. This, however, does not materially affect the descriptions given.

The remarks with reference to fig. 1, regarding the discharge path of the shunt field when the rheostat is in the "off" position, can be made to apply to any of the above designs by the addition of a special contact and a slight modification of the connections.

The above descriptions can only be regarded as typical of the many interlocks on the market. This especially refers to the mechanical devices, the actual number of designs of which is enormous—modifications being made to suit special cases and starters.

It is difficult to compare the advantages and disadvantages of the types mentioned, because each has its particular value in the case for which it is designed. For instance,

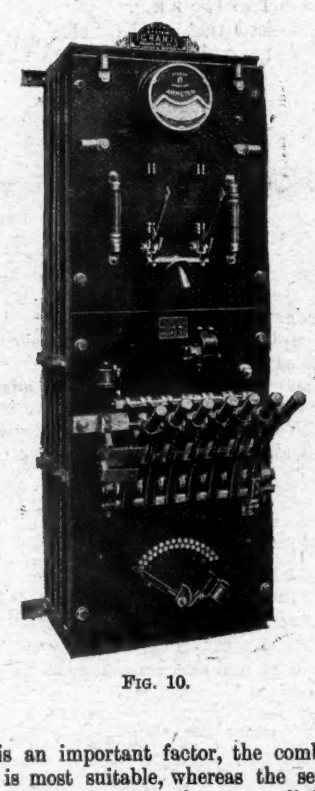

Fig. 10.

where space is an important factor, the combined starter and regulator is most suitable, whereas the separate pieces of apparatus are more suitable when controlled from a distance—as mentioned before.

Several of the most prominent manufacturers have been most obliging in giving information, those to whom the authors are most indebted being Messrs. Brook-Hirst, Veritys, Adams Manufacturing Co. and Felten-Guilleaume Lahmeyerwerke.

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**Copper.**—Messrs. Merton's statistical circular again shows an increase in visible supplies, which for the end of September, 1909, are 93,851 tons, an advance of 5,533 tons on the return for the end of August. The increase is divided between standard copper stocked in England and France, and that afloat from Australia. The supplies from North America are below the average, from Spain and Portugal slightly above, while the shipments from Chile and Australia are about one-third higher than usual. Total supplies are 5,633 tons above deliveries. Compared with last year, supplies are lower in all cases. The total for the year ending September 30th, 1908, was 473,914 tons, as against 433,000 tons for the current year.

# BUSINESS NOTES.

**Standardised Publications.**—We are informed that the Engineers' Standardised Publications Association, of Craven House, Kingsway, which was formed a few months ago to promote reform in the sizes of price lists and catalogues, has received sufficient support to enable it to commence work with good prospects of success. Amongst those who have joined, we note the names of many well-known engineers and firms, including a score of borough electrical engineers, several consulting engineers, and a number of manufacturing companies. The main objects of the Association are to classify and standardise trade publications, so that they may be conveniently filed and indexed, and thus may form a useful reference library instead of finding their way to the W.P.B.

**Motor Exhibition at Olympia.**—We are informed that the only International Exhibition of Motor-cars this year will be held at Olympia, London, from November 12th to November 20th inclusive, under the patronage of H.M. the King. There will be no exhibitions in Paris and the other Continental capitals this season, and therefore the London Show, which will be the eighth held by the Society of Motor Manufacturers and Traders with the co-operation of the Royal Automobile Club, is expected to bring over a large influx of visitors and buyers from other countries. London is stated to be becoming the motor mart of the world. Amongst the 300 firms who will be displaying their wares at Olympia will be the principal manufacturers of Great Britain, France, Germany, Belgium, Italy and America, and the very latest ideas in motor construction will be on show. The growing strength of the motor industry in this country, despite its having been handicapped in the early days by repressive legislation, will be proved beyond a doubt, and it is no slight evidence of its vitality that England alone of all the manufacturing countries has been able to withstand the recent "slump" in trade and hold an exhibition when every other country has, through pressure of hard times, had to abandon such a venture. During the past year important structural alterations have been made in the great building of Olympia, which, although the largest available for exhibition purposes in London, has not been in the past large enough for the purpose. With the view of adding to its convenience, the large annexe has been thrown into the main hall so as to form one large space open to the best display of motor-cars. The area of this vast hall is now so large that visitors will require to walk three miles if they wish to see every stand. It will be the greatest exhibition of its kind ever held in this country.

**Catalogues and Lists.**—The General Electric Co, Ltd., 71, Queen Victoria Street, London, E.C.—Still they come, these lamp posters!—but we hope that they are not going to continue to increase in size, or they will be too cumbersome even as draught excluders. "Osram" lamps are destined to appeal to every household—that is the intention of the G.E.C. and its publicity department, and the services of the inevitable and irrepressible Mr. Hassell have once more been requisitioned to drive home to the public mind in a striking and popular way the fact that they burn "20 hours for one penny," to the evident delight of the British workman and his left-handed wife. So simply expressed is this truth that even the bairns (whose faces, by the way, we should have preferred to see) are flabergasted at the cheapness, and their hunger is forgotten while they behold the "Osram" above their heads in preference for the somewhat substantial and comprehensive meal that lies awaiting them. The most catchy part of the poster is that feline attitude—the matron's manner gives us a cold shiver down our back, though the pie dagger is where it is. These posters are available in bulk for electrical contractors who apply for them.

The Unbreakable Pulley and Millgearing Co., Ltd., Hyde Road Engineering Works, West Gorton, Manchester.—Hanging card showing illustrations of some of their clutches, pulleys, &c., and giving several reference tables for engineers, showing horse-power of shafting and pitch of bearings, rim speeds of pulleys of various diameters at varying numbers of revolutions, and horse-powers of leather belting at various speeds.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—Price leaflet showing full-size illustrations of "Eclipse" metallic-filament lamps for high and low voltages and the usual candle-powers; also battery lamps and lamps of high candle-power.

Messrs. A. P. Lundberg & Sons, 477-487, Liverpool Road, N.—Illustrated lists No. 8, 21 and 22, prepared in their usual style, and giving descriptions and prices of their "Tripin combination" switch and three-pin wall connection, and their "Presto" tumbler switch.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Another new pamphlet (No. 18A), describing, illustrating and giving dimensional and other tabular information relating to their Peebles continuous current dynamos and motors (open type) up to 1,500 h.p. and 1,100 kw.

Messrs. Simplex Conduits, Ltd., London and Birmingham.—New 1909-10 catalogue of conduits. It is a bulky publication of close upon a hundred pages of well-arranged matter, with a host of illustrations and particulars of prices, relating to the manufactures coming in sections T, U, D, and M of their catalogue. These are: conduits and fittings for electric light and power wiring; the Simplex flexible wiring system; distribution boards, switchgear, and enclosed fuses; also watertight fittings for mills, ships, &c.

Messrs. Classen & Co., Berlin W. 30/48, Germany.—Leaflet describing their "Fludor" soldering lamp, a neat and convenient little blow lamp burning methylated spirit, for use especially with the Fludor soldering materials.

The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—A finely-produced brochure of 48 pages entitled "Electricity for all Industrial Uses—illustrating the utility of the electric motor." Views of large polyphase generators and motors, with a view of the Union Works, lead off, and other beautifully executed pictures occupying alternate pages show Union motors applied to many different varieties of service, among them being the driving of conveyors of screen separators in coal mines, mine exhausting fans, three-throw ram and other pumps, plate bending and straightening rolls, lathes, boring mills, drills and other machine tools, textile factory and wood-working machinery, portable cranes for civil engineering works, tile-making machines, newspaper printing machinery, and a number of other departments of industry. Appropriate letter-press faces each page of illustrations. The book should be useful to those who are trying to interest the prospective power-user.

Westinghouse Companies' Publishing Department, Westinghouse Building, Norfolk Street, W.C.—30-page pamphlet containing a very full description with half-tone and sectional views of Halpin's patent thermal storage system for economy in steam raising (for which Mr. P. J. Mitchell, of Caxton House, S.W., is sole licensee for England and the Colonies), together with particulars of tests, opinions of users, &c.; also a 12-page pamphlet describing the McKenzie Holland, and Westinghouse all-electric power signalling at Yarnton, Great Western Railway.

The Reason Manufacturing Co., Ltd., Brighton.—24-page pamphlet, set out in the firm's standard style, containing a full description, with illustrations showing interiors, of their electrically wound time switches for continuous and alternating current. A list of prices of different types is given.

Messrs. Royce, Ltd., Trafford Park, Manchester.—New booklet consisting entirely of a large number of excellently executed half-tone prints on art paper, showing their specialities. These include a number of views of their electrically driven "Goliath" cranes, overhead travellers, cantilever cranes, walking cranes, jib cranes, transporters, standard winches and capstans, slow-speed crane motors, electrically operated worm-gears and controllers. This collection is a temporary substitute preparatory to the publication of the fifth edition of the firm's catalogue.

Messrs. Home & Rowland, Troughton Road, Charlton, Kent.—Two new price lists, one dealing with their auto-transformers for use with arc lamps, very fully detailing the prices in table form; the other similarly setting forth the prices of auto-transformers for use with metal-filament lamps. They also quote for other auto-transformers not included in the lists.

Messrs. G. M. Boddy & Co., 15, Gray's Inn Road, W.C.—Leaflets relating to the "Metalik" lamps, which are now supplied of 14 British c.p. for 60 to 130 volts, and 22 c.p. for 200 to 260 volts, these, it is claimed, being the lowest candle-powers on the market.

The Electrical Co., Ltd. (Metals Department), 121-125, Charing Cross Road, W.C.—Folders relating to their system of producing metal parts with hardened steel dies under heavy hydraulic pressure, with accuracy and certainty and without the defects incidental to the casting process.

Messrs. E. Goossens, Pope & Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.—A handy pocket pamphlet of 16 pages, containing full-sized illustrations of the firm's metal-filament lamps. The pages are not overloaded with matter, so the blocks stand out effectively, a boldly stated bulb reference letter, voltage and candle-power being all that is given. Prices of all shapes are clearly tabulated on a page at the end.

**Installation Contracts.**—Messrs. Edwards & Armstrong, of Bristol, have just completed the installation of the generating plant and underground system of mains for the town of Tewkesbury, and a 43-b.h.p. suction gas plant, 1,100-ampere-hour battery, underground mains, and wiring for 1,000 lights at the Brislington Asylum, near Bristol. They have in hand the following:—

Complete generating plant and underground system of mains for the town of Chippenham.
190-b.h.p. steam dynamo, motors, arc and other lighting for the Holywell Co., Ltd.
Complete plant, accumulators, &c., for Bucknill House, Shropshire.
Complete plant, accumulators, &c., for The Hill, near Banbury.
Complete plant, accumulators, &c., for Crown Hotel, Bridgnorth.
630-ampere-hour battery for Somerford Manor, Wilts.
50-b.h.p. three-phase motor and complete wiring for Co-operative Stores, Whitehall, Bristol.

**Bennis still Going Strong.**—From Messrs. E. Bennis & Co., Ltd., of Little Hulton, we have received their latest list of contracts secured for their well-known stokers. These are for such firms as Bessemer's, of Sheffield; Ruston Proctors, Clarke, Chapman & Co., for Chatham Dockyard and for South Africa, and for a number of mills in Preston, Keighley, Dewsbury, &c. We understand that 65 per cent. of the orders secured are for the firm's new gritless and smutless coking stoker.

**Indian Electrical Installations.**—The following are particulars of some electrical contracts that have recently been secured by Messrs. Walter Locke & Co., Ltd., of Calcutta:—

Hathaunda Palace, Daryabad, for the Rajah Prithwipal Singh.—Installation consisting of Crossley oil engine, Rhodes dynamo, J. P. Childs & Co.'s lift for four stories, 50 "Locke" fans, an Albany pump, motor-driven by a Rhodes motor, battery of 55 Hart cells, switchboard and wiring to 250 light and fan points.

Midnapur Palace, for Rajah Norendra Lall Khan Bahadhur, of Midnapur.—Installation consisting of Ruston-Proctor steam engine combined with Rhodes dynamo, 800 yards overhead main cable,

battery of 60 Hart cells, switchboard, 25 "Locke" fans and wiring to 150 light and fan points; "Locke" metallic-filament lamps to be used throughout.

The New Premises in Calcutta of the Allisnce Bank of Simla.—Installation consisting of wiring to 266 light and fan points for connection to the mains of the C.E.S. Co., fancy fittings, and 73 "Locke" fans.

The New Pump House at the Pulta Pressure Station for the Calcutta Corporation (per Messrs. Jas. Simpson & Sons).—Installation consisting of Reader steam engine combined with Rhodes dynamo, wiring, &c., to some 36 points.

**Chinese Tantalums.**—We recently illustrated the Russian adaptation of the Siemens Satisfied Consumer show-card. We are now pleased to learn that the makers of tantalum lamps are appealing to the people of China to allow them to throw the bright rays of these lamps to help them in their awakening. As we showed in our comments on the Chinese market recently, useful

It Speaks for Itself.

popularising work is possible over there with the aid of the fetching coloured poster, and the accompanying block shows how it looks in the Chinese lingo. Siemens Bros. Dynamo Works Co., Ltd., of Dalston, have now introduced these for popularising tantalums in English-speaking countries, in Russia, Spain, Portugal and China.

**Bankruptcy Proceedings.** — *Re* Herbert John Burdett, electrical engineer and contractor, Rugby.—This debtor came up for public examination on Monday at the Coventry Bankruptcy Court, before Mr. Registrar Kirby. The statement of affairs showed gross assets £1,214, and there was an estimated deficiency of £819. In reply to the Official Receiver (Mr. C. J. Band), debtor said he commenced business in the early part of 1902 at Castle Street, Rugby, subsequently removing to larger premises in Regent Street. He began with £150 capital, his own money. When he prepared a balance-sheet six months ago he took his stock at cost price, and this showed he was quite solvent. His stock then came out at rather more than £400. He now estimated it, at breaking-up price, at £120. He could not account for anything during the past six months to explain the £819 deficiency besides the difference in the value of the stock and severe competition. He did not file his petition earlier because he hoped to pull the business round, and he cut down expenses. The causes of his failure were: bad trade, competition and illness. In reply to Mr. A. Cripwell (Trustee), debtor stated that he had not been executing contracts at, or under, cost price, but with a very small margin. He had an arrangement with the bank for an overdraft of £100, and at the time of filing his petition it stood at £75. The overdraft was guaranteed by his brother-in-law. In answer to his solicitor (Mr. H. L. Reddish), debtor said he had been hopeful of arranging a composition. The examination was closed, conditional upon debtor supplying a cash account covering his last 12 months' trading.

Arnold Roberts, electrical engineer, Rawdon, Yorks.—October 26th is the last day for the receipt of proofs for intended dividend by the trustees, J. H. Haley and R. A. Venter, Bradford.

Ernest Fenwick Jones, electrical engineer, &c., 132, York Road West, Hartlepool.—This debtor attended the Court House, John Street, Sunderland, last week for his public examination, the deficiency being stated at £487. The case was ordered to stand adjourned.

J. G. S. Cunnington & H. P. Alison, electrical engineers and contractors, Great Newport Street, London.—The last day for receipt of proofs for intended dividend, by the trustee, Mr. A. Page, 28, King Street, E.C., is October 26th.

Herbert Shuttleworth, electrical engineer, Cross Court, Briggate, Leeds.—October 28th is the last day for receipt of proofs for dividend by the Official Receiver, Mr. J. Bowling, 24, Bond Street, Leeds.

**Dissolutions and Liquidations.**—Halls Transmission Gear Syndicate, Ltd.—A meeting is to be held on November 15th at 9, Little Trinity Lane, E.C., to hear an account of the winding up from the liquidator, Mr. T. D. Cocke.

Morton, Butler & Co., electrical and mechanical engineers, Nettleton Road, Mirfield.—Messrs. J. D. M. Morton and J. D. Butler have dissolved partnership.

**Trade Announcements.**—Messrs. Geary, Adams and Co, Ltd., have been appointed sole agents for Birmingham and district for Messrs. Davey, Paxman & Co., Ltd., Colchester.

The Accessories Manufacturing Co., Ltd., have appointed Mr. J. W. Beswick, of Temple Chambers, 33, Brazennose Street, Manchester, as their representative in Manchester and district.

The Rotherham Electrical Engineering Co. have commenced business at 39, High Street, Rotherham.

The Davis Electrical Co., Ltd., 17, Moor Street, W., announce that they have acquired the works and stock of the Royal Standard Electric Lamp Manufacturing Co., and they have sent us an illustrated price-list of the lamps.

Messrs. R. H. Hayne & Co. have removed from Gloucester Mansions, W.C., to 72, Finsbury Pavement, E.C.

**Book Notices.**—The *Journal* of the Municipal School of Technology, Manchester. Vol. I, Part 3. Manchester: The School.

"The American Institute of Architects' Quarterly Bulletin." July, 1909. Vol. X, No. 2. Washington, U.S.A.: The Institute.

"Post Office Electrical Engineers' Journal." October. Vol. 2, Part 3. London: H. Alabaster, Gatehouse & Co. Price 1s.

"*Mechanical World* Pocket Diary and Year-Book, 1910." Manchester: Emmott & Co., Ltd. Price 6d. net.

"Dynamo Electric Machinery: Alternating-Current Machines." By S. Sheldon, H. Mason, and E. Hausmann. Eighth Edition. London: Crosby Lockwood & Son. 1909.

"Wireless Telegraphy and Wireless Telephony." By A. E. Kennelly. London: T. Fisher Unwin. 1909. Price 4s. net.

"*Journal* of the Institution of Electrical Engineers." No. 197, Vol. 43. This number contains the following papers:—"The Electrical System of the L.C.C. Tramways," by J. H. Rider; "Theory and Application of Motor Converters," by H. S. Hallo; "Extending the Limits of Power Transmission," by A. M. Taylor; "Vagabond Currents," by J. G. and R. G. Cunliffe; "Electrification of Steam-driven Non-reversing Rolling Mills," by W. F. Mylan; and "Interpole Designs," by W. B. Hird. London: E. & F. N. Spon, Ltd. Price 5s.

"Statistics of Public Education in England and Wales." Part I. Educational Statistics, 1907-8. London: Wyman & Sons, Ltd. 1909. Price 2s. 3d.

"Rose's Universal Code Economiser." By Sydney A. M. Rose, A.M.I.E.E. London: Sidgwick & Jackson. Price 10s. 6d.

"Institution of Electrical Engineers. Articles of Association, and List of Officers and Members." 1909. From the Institution.

"Jack Carstairs of the Power House." By S. Sandys. London: Methuen & Co. 1909. Price 6s.

We have received a copy of the first issue of *Surveying and the Civil Engineer*, a new weekly journal for surveyors and civil and municipal engineers. Mr. B. Wyand, formerly on the editorial staff of the *Surveyor and Municipal and County Engineer*, is the editor of the paper, which is owned by the proprietors of the *Pall Mall Gazette*. *Surveying* is handsomely produced, and contains many interesting and practical articles, with well-printed illustrations. We wish it a prosperous and useful career.

## LIGHTING and POWER NOTES.

**Accrington.**—The assessment of the Electricity Works having been very much increased, the T.C. has decided to lodge an appeal.

The electrical engineer reported last week that the recent exhibition had cost £154 in round figures, exclusive of permanent staff wages and electricity consumed. The receipts amounted to £140, and about 5,000 units had been used.

**Bexhill.**—The T.C. on Monday decided to apply to the L.G.B. for a loan of £2,560 for cable extensions to the Little Common district, and to provide the E.L. in each of the West Parade shelters.

**Brandon.**—The U.D.C. has decided to give the necessary six months' notice to the colliery companies supplying electricity to the Council, with the object of inviting fresh tenders.

**Canada.**—A meeting was held in Toronto on September 29th for the purpose of renewing the interest of the Municipalities in the hydro-electric power scheme. The Commission was represented by Hon. Adam Beck, chairman, while the visitors included representatives from the towns of St. Thomas, Hespeller, Waterloo, Toronto, Berlin, London, Guelph, St. Mary's and Stratford. Following an informal discussion, Mr. R. A. Ross, Montreal, consulting engineer of the Commission, was chosen chairman, and Mr. E. Clarence Settell, secretary of the Commission, secretary. Municipalities who have not at present civic lighting were represented, and much technical conference work was gone over in detail.

The Dominion Government has given a grant of 25,000 miners' inches of water on Lilloet River to the Burrard Power Co., of Vancouver, B.C. Under the terms of the grant the harnessing of the waters of the Lilloet will be commenced at no distant date, and as the power plant will be only 23 miles from Vancouver, it is declared that it will not be long before some sections of industrial Vancouver will be drawing power from this source.

**Coatbridge.**—Messrs. Stewart & Lloyds, at a recent meeting of the Dean of Guild Court, have received permission to proceed with the erection of an electric sub-station to drive motors at the British Tube Works, Dundyvan Road, Coatbridge.

**Continental Notes.**—France.—The Paris-Orleans railway has just ordered 900 Brown, Boveri equipments for the lighting of railway coaches, each consisting of a 2-kw dynamo and an automatic regulator.

Holland.—Work is about to be commenced on the establishment of a central electric lighting station in the town of Dordrecht.

Austria.—It is proposed to put down a plant to utilise the water-power of the River Gacka, near Otocal (Croatia) in the generation of electrical energy for lighting and power purposes.

**Cookstown.**—The Council last week considered the report of Mr. H. V. Pegg, on the scheme for the electrical lighting of the town. A motion to hold a meeting of the ratepayers of the municipal district was carried by the chairman's vote.

**Co. Durham.**—The County of Durham Electric Power Supply Co. has applied to the B. of T. for permission to use an extra high-tension overhead transmission line between Fell Bank, Birtley, and Harraton Colliery, and a similar line between the sub-station at Arkley Heads and Cater House Pit.

**Dawlish.**—On Wednesday, last week, at the meeting of U.D.C., mention was made of the receipt from Mr. Purves (on behalf of the provisional board of directors formed with the object of carrying out, if possible, an electric light undertaking for Dawlish) plans showing where it was proposed to lay the mains, and also a sketch of the poles proposed to be used for overhead mains, asking the Council's approval thereto. The surveyor reported that, although he recommended underground mains, he did not see much objection to the Council allowing overhead mains in the rural parts. The committee recommended the Council to approve underground mains from Queen Street to Luscombe Terrace and from Old Town Street and the Bartons, and that ornamental posts be required in some parts of the district for overhead mains. The question of arc lighting was deferred for a statement as to the cost in comparison with the existing system of lighting.

**Dundee.**—The question of the better lighting of the Lochee High Street has recently been under consideration, and the relative merits of gas and electricity were fully discussed. It has been agreed to recommend that the street be illuminated by electricity.

**Ellesmere Port.**—Mr. W. H. Wilson has informed the U.D.C. that he intends applying for a prov. order for E.L. The Council has decided to consent to the application provided it is empowered to acquire the undertaking at any future time on terms to be arranged, and on condition that the price for energy is agreed upon.

**Gillingham (Kent).**—The T.C. has agreed to supply electricity to the whole of the R.E. barracks, including the non-commissioned officers' mess quarters and the Government House and future extensions, for a period of five years, at 2¾d. per unit, The Government will pay the cost of necessary cables, &c.

**Glasgow.**—The Clyde Trustees have decided to proceed with the erection of a large granary at Meadowside with two travelling grain elevators on the quay; these latter and all the necessary appliances are to be operated by electricity.

**Hessle.**—The U.D.C. has informed Hull T.C. that it is unable to accept the offer of the Corporation for a supply of electricity. The negotiations are to be continued by committees from both bodies.

**India.**—Advices from India state that it is believed that the great Simla hydro-electric scheme will be completed in 1911.

**Kingswinford.**—At the monthly meeting of the R.D.C. on Monday, it was stated that Mr. W. R. Cheldon, of Lincoln's Inn, London, had been appointed by the B. of T. to determine matters in the dispute between the Midland Power Co. and the Council.

**London.** — Camberwell. — The South Metropolitan Electric Light and Power Co. submitted a plan to the B.C. for lighting Crystal Palace Parade with flame arc lamps. One scheme would cost £210 per annum, and £360 to install, and the other scheme would cost £126 per annum and £360 to install. The matter was considered by the Works Committee, who decided that though the candle-power supplied would be greatly superior to that given by the gas company, neither of the schemes proposed could be adopted in view of the large extra cost it would incur.

Westminster.—The City Council has received communications from the Shoreditch, Greenwich, Hammersmith and St. Pancras B.C.'s concurring in the Westminster protest against the policy of the L.C.C. in encroaching on the jurisdiction of Metropolitan B.C.s in the electric supply and other private Bills.

**Macclesfield.**—In reply to an inquiry from the B. of T. as to whether the T.C. intends to proceed with the prov. order, the town clerk has replied that the Electricity Committee will be prepared at the proper time to consider and recommend a scheme to the Council. At present there was no demand for electricity, as several large tradesmen and manufacturers had their own private installations. If there was sufficient demand which would justify the Corporation in erecting works without any financial burden to the rates, which at the present time are heavy, the Council would be prepared to favourably consider the matter.

**Merthyr Tydfil.**—The Public Works Committee of the T.C. has decided to accept the tender of the Electric Traction Co. for public lighting at Merthyr Vale and Aberfan at £535 per annum, with 119 two-light lamps. The present cost with gas and acetylene is £570.

**Newcastle (Co. Down).**—At the monthly meeting on the 4th inst., the Council had under consideration the question of lighting the town by electricity, and correspondence from a number of electrical engineers on the subject was submitted. A Lewisham firm, in reply to the Council's queries, wrote fully as to the proposed installations for lighting and power purposes in the town, and desired the Council's consent to its applications for a prov. order. The Lighting Committee's recommendations that the correspondence with the Lewisham firm be submitted to the Council's solicitor for his legal opinion, was adopted, and it was decided to write electrical engineers practising in Belfast and Dublin, asking their fees for the preparation of a report and estimate on the subject.

**Oulton Broad.**—The U.D.C. has received six or seven inquiries respecting the working of the Council's E.L. Order. A Committee of the Council is to confer with representatives of firms, &c., including those of the Oulton Broad Electricity Co., Ltd., and Lowestoft T.C.

**Royton.**—The Oldham T.C. having been asked to supply electricity in Royton, has applied for the consent of the U.D.C., and the matter has been referred to a Committee.

**St. Helens.**—The T.C. has received from the L.G.B. sanction to loans of £3,254 for motor-generators, transformers, switchgear and service lines, and two sums of £4,746 for high-tension feeder mains.

**Sidmouth.**—The B. of T. has revoked the 1903 E.L. order.

**South Africa.**—Power Commission evidence continues to accumulate, one of the recent witnesses being the Mayor of Pretoria who raised the arguments, familiar over here, as to the prior right of the municipality and as to the necessity of avoiding competition in the area. He considered that the T.C. should, subject to Government approval, be able to refuse the privilege of laying mains in the city. An interesting witness was Mr. I Haarhoff, who dealt with the farming interests. He said that the farmer could, on the co-operative principle, purchase an electrical ploughing outfit. Electric ploughing would save labour; if on the Fillet system it could go 20 in. deep as against 6 in. in the ordinary way. It was not impossible to have electric reapers for wheat, oat-hay and maize; mechanical irrigation would also be successful, and this would enable the Transvaal to compete with the coast.

**South Shields.**—At a meeting of the T.C., on the 6th inst., a report by the Finance Committee was submitted which recommended that the salaries of the following officials be reduced:—The town clerk from £1,000 to £800 per annum; borough accountant, £600 to £500; electrical engineer from £650 to £500; medical officer, £500 to £400, &c. Alderman Readhead said he was not in favour of the proposals, and it would not be wise for him to move its adoption. Alderman Scott moved, and Mr. Andrew Anderson seconded, formally, the report. There was considerable discussion, and the matter was adjourned till Monday last, when the proposal was rejected by 36 votes to 10.

**Sowerby Bridge.**—The transfer of the Council's E.L. order to the Electrical Distribution of Yorkshire, Ltd., has been completed. The company has paid the U.D.C. £318, the agreed purchase money.

**Stevenage.**—The proposal of a private person to take over the electrical prov. order has fallen through owing to terms not having been arrived at with Messrs. Crompton & Co. The U.D.C. has decided to ask the latter firm to assist it in the matter.

**U.S.A.**—One of the most interesting engineering exploits of the present time is being carried out in California, where the city of Los Angeles is constructing a water conduit some 230 miles long from the Sierra Nevada Mountains across the desert. The conduit will fulfil several objects, as it is to provide drinking water, irrigate land near the city, and provide hydro-electric power. The conduit work, exclusive of power development, is estimated to cost $24,500,000; it comprises canal, tunnel and siphon construction. The source of water is the Owens River, and several storage reservoirs are being formed at different points on the route of the conduit. The difference in level between the intake and Los Angeles is some 3,500 ft., and it is possible to develop 75,000 H.P. at some 40 miles from the city, where there is a fall of 1,500 ft., the power plant, transmission, &c., being estimated to cost $4,500,000. Electricity is being largely used in excavating, transporting and drilling, power being furnished from mountain streams in three hydro-electric plants of 3,300 H.P., and utilised after transmission at H.T. over the route some 150 miles.

**Whitby.**—The annual report of the Council's electric lighting department, just issued, shows a profit for the year of £700, which is far in advance of any other year. The revenue has increased by £483, while the expenditure has only been increased by £19.

**Whitehaven.**—The T.C. has lost the contract for lighting the harbour for five years by electricity, the terms submitted being considered by the Commissioners to be too high.

**Yarmouth.**—The L.G.B. has sanctioned the Council borrowing the sum of £2,000 for house services in connection with the electric light undertaking.

# TRAMWAY and RAILWAY NOTES.

**Argentina.**—The Public Works Committee of the Deputies has reported favourably on the petition of the Central Argentine Railway Co. to construct a tube railway between Retiro, Casa Amarilla and Constitucion.

Messrs. Guerrico & Williams have applied to the Buenos Aires Legislature for a concession for electric tramways in Bahia Blanca. The Pacific and Southern Railways are at present constructing electric tramways in that city.

During the first seven months of the year, the Buenos Aires tramways carried nearly 159 million passengers, 630 km. of electric and 1 km. of horse line being in use.

**Bradford.**—The tramway undertaking created a record during the half-year ended September 30th. The income approximated to £130,500, an increase of £4,100 over the corresponding period of last year, whilst the expenses decreased by £1,800. Last year the net profit was £13,900, whilst in the past half-year it was roughly £19,900. The number of passengers carried was 25,617,866, an increase of 688,645.

**Canada.**—The directors of the Ottawa and St. Lawrence Electric Railway Co. are reported to be selling their charter to English financiers. The scheme includes 254 miles of route, passing through 50 towns, and will cost $4,000,000. Work will be commenced on the scheme next year.

**Cardiff.**—At a recent meeting of the Electricity and Tramways Committee, the report of Mr. W. Howard Smith, of London, on the condition of the tramway tracks came up for consideration. Some dissatisfaction was expressed because the report generalised, and did not specify what remedies should be adopted. In the end, it was agreed that Mr. Harpur (city engineer) and Mr. Ellis (electricity and tramway manager) should report on the expert's report within a fortnight, if possible, and that the matter should be considered at a special meeting.

**Continental Notes.**—GERMANY.—The laying of a memorial stone in connection with the construction of an electric railway between the Berlin suburbs of Wilmersdorf and Dahlem took place at the Hohenzollern Platz, in Wilmersdorf, on October 5th. By a coincidence, an application to the Civil Court in connection with this scheme was heard and decided the previous day in the Landgericht I. The application, which was made by the town of Charlottenburg against the Elevated and Underground Railway Co., sought to obtain a provisional injunction to restrain the company from proceeding further with railway schemes, particularly in conjunction with the town of Wilmersdorf, which would render it impossible to connect the projected Charlottenburg underground electric railway with the station at Wittenberg Platz, and to operate trains in through traffic by running over the lines of the elevated railway. It appears that an agreement exists between Charlottenburg and the company, whereby a physical junction should be made between the two railways, but the former had refused the offer of a joint station and connection in the Uhlandstrasse. The Court dismissed the application, and the dispute is to form the subject of further proceedings unless the proposals to be made by the Prussian Minister for Railways meet with the approval of the interested local authorities.

The Continental Co. for Electrical Enterprises, which has for a long time past been seeking to obtain a concession for the construction of a suspended railway from Gesundbrunnen to Rixdorf, has submitted a fresh proposal to the Rixdorf Town Council. It appears that the latter's inclination rather lies in the establishment of an underground line from the north of Berlin to Rixdorf, and the negotiations with the company have consequently been at a standstill. Now, however, the company has resumed negotiations, and has offered in consideration of the grant of the right to use the streets in Rixdorf to introduce a uniform fare of 10 pfennigs (1½d.) for the transport of passengers over the whole distance between Rixdorf and Gesundbrunnen, this rate comparing with the cheapest charge of twice this amount prevailing at the present time. Apart from this suburban question the company has now discontinued negotiations with the Berlin Municipal Highways Committee in respect of a concession for a suspended railway in Berlin. The company, in fact, after efforts extending over eight years, has withdrawn its offer, and has asked the State authorities to substitute their consent under the Secondary Railways Law for that of the city of Berlin in relation to the use of the streets. The action of the company is attributed to the circumstance that in consequence of the demands made by the Highways Committee, the fares would have been arranged on such a high level that it would have been impossible to establish a tariff which would permit of all classes of the population utilising the railway. It is considered to be an unconditional requirement that the passenger fares on the railway should not be materially higher than those charged on the tramways.

The Bavarian Ministry for Railways recently specified seven different sources of water-power as State property for use in connection with the projected electrical working of railways, including the Walchensee. It is assumed that the remaining water powers will be available for other purposes. Negotiations are proceeding with regard to the disposal of the water-power of the Alz, although these are specially influenced by the fact that the Austrian Government, on the principle of territorial sovereignty, claims the independent right of disposal with regard to the utilisation of Austrian water courses which enter Bavaria. The question is also engaging official attention in Prussia, where the Ministry for Railways is reported to desire to devote the sum of £2,500 to proceeding with preliminary works. Apart from this circumstance, the Konigliche Akademie des Bauwesens some time ago instituted a prize competition to advance the problem by attempting to secure comparative essays on water-power installations carried out, with a view to their serving as a model for future work in Germany. But as the contest took place at the same time as the Bavarian competition in connection with the Walchensee scheme, it only resulted in the presentation of five compositions, of which nothing further has been heard. On the other hand, the Walchensee contest resulted in the receipt of 30 proposals from the principals of the hydraulic profession throughout the world, and these are said to represent a wealth of technical knowledge. It is now suggested that the Prussian Minister should take steps with a view to the information thus rendered available in Bavaria becoming known among a wider circle throughout the empire.

TURKEY.—The August number of the *Revue Commerciale du Levant* states that there is an opening for a tramway system at Ada Bazar. It is pointed out that the town is very scattered, and situated on level ground; that there is a large amount of traffic, and that the railway station is at the extremity of the town. Ada Bazar is situated on the Anatolian Railway, at a comparatively short distance from Scutari and Constantinople.

SPAIN.—The Compania General de Tranvias, of Barcelona, has applied for a concession for a projected electric tramway between Sans and Coll-Blanch (Barcelona).

**Devonport.**—The Tramways Committee of the T.C. reports the receipt of a letter from the Devonport and District Tramways Co., containing certain proposals for the sale of the company's undertaking to the Corporation, such letter being without prejudice, and to be treated as private unless the Committee was prepared to recommend the proposals to the Council for adoption. It was resolved that the Tramway Co. be informed that the proposal was not one which the Committee could recommend to the Council for adoption, but that it was prepared to consider the matter further if the company could submit a definite figure.

**Dunfermline.**—Col. von Donop, who will examine the tramway for the B. of T., has intimated that he will consider the question raised by the T.C. as to the terminus of the line in Dunfermline. The tramway company wrote the T.C. stating that the petition of 1,300 ratepayers asking the company to implement the terms of its order and take the line to Mileswark would not facilitate matters. The Council will delay further representations until the B. of T. visit takes place.

**Gateshead.**—The T.C. has approved of the application of the Gateshead and District Tramways Co. for a further extension of time until October 22nd, 1910, for the completion of the Wreckenton Light Railway.

**Glasgow.**—For some time past the Tramways Committee of the T.C. has been in negotiation with the Calico Printers' Association for the purchase of a corner property in Thornliebank, for the purpose of laying a double line of rails in accordance with the prov. order upon which the extension was authorised. The County Council of Renfrewshire has threatened proceedings in the Court of Session failing compliance with the terms of the order, but as the Calico Printers' Co. will not accept less than £1,000 for the property, matters have reached a deadlock.

The proposal to provide a long-service fund for motormen and conductors in the service of the T.C. department has again been under consideration.

**Halesowen.**—At a meeting of the U.D.C. last week it was reported that considerable progress was being made with the scheme for the construction of a light railway; and that the Worcestershire County Council had given notice that it intended immediately to carry out the widening of Long Lane, which will facilitate the light railway work.

**Kingstown (Dublin).**—The report of Col. von Donop (Board of Trade) as to increased speed on the Dalkey line has been submitted to the Council. It appears that a committee of the Council arranged with the inspector for the granting of increased speed at either end of the business district, the company withdrawing its application as regards the congested portion of the town. Several councillors disputed the authority of the committee to make concessions, but ultimately the report was agreed to.

**London.**—In connection with the Brighton Co.'s South London electrification, the company has, with the sanction of the B. of T., arranged for one of its three running lines between London Bridge and South Bermondsey to be used alternately for up and down traffic (morning and night) thus greatly increasing the capacity of the line. In order to achieve this result separate sets of signals have been provided for up and down work on this track, interlocked so that only one set can be used at once.

The death of a lineman, employed by Messrs. Blackwell, which occurred a few days ago at Peckham on the Brighton Co.'s electrical section, was investigated by the Camberwell Coroner on Monday. It appeared that Younger climbed one of the gantries from which the 6,500-volt overhead wires are suspended in order to obtain a clip, and in some way touched one of the live wires,

being killed instantly. Medical evidence showed that the body was frightfully burned, and that many fractures resulted from the fall on to the track.

On Monday the Hampstead, Bakerloo and Piccadilly Tube railways instituted an accelerated service of trains. On the Hampstead line during the busiest hours, 42 trains an hour were maintained, or at 86-second intervals, and this is regarded as the limit by the railway authorities, it having necessitated a rearrangement of the signalling system. In all, 1,300 trains a day are run on this line. The "Bakerloo" was able to run 40 trains an hour, and on the Piccadilly tube 30 trains an hour were run. All three tubes run non-stop trains, or trains which miss certain stations alternately during rush hours. One daily paper, after remarking that this system gives a substantial saving of time, gravely records the fact that one traveller from Holloway spent 35 minutes in confused journeyings between King's Cross and Finsbury Park in the effort to arrive at his station.

On Wednesday, last week, the new L.C.C. tramway between Queen's Road, Battersea, and Clapham Junction, was inspected by the B. of T., and later in the week it was opened for traffic.

On Friday last a L.C.C. Merton car ran away down the hill between Balham and the terminus, colliding with a stationary car and injuring three people. It is reported that the brakes were defective.

A report submitted to the L.C.C. by the Highways Committee states that the tramways system at March 31st, 1909, extended over a total length of 127⅝ street miles, being 85⅝ miles of electric lines and 42 miles of horse lines. The capital expenditure on the undertaking amounted to £9,483,561, of which £1,068,971 represents expenditure during the year 1908-9. The debt outstanding was £8,043,139. The total receipts during the year from electric traction were £1,572,251, and the working expenses £896,286, leaving a surplus of £675,965; and the corresponding figures for horse traction were £275,199 and £305,402, leaving a deficiency of £30,202. After debt charges and other deductions had been made there remained a net balance of £107,570. There were 344,705,937 passengers carried on electric cars, and 68,207,004 on horse cars, a total of 412,913,841. The number of car-miles run was 31,962,784 miles by electric traction and 7,156,688 by horse traction, a total of 39,119,472 miles. The average fare per passenger was 1·05d.

**Morecambe-Heysham.**—Much curiosity, says the *Pall Mall Gazette*, has been expressed from time to time as to the performance in service of the single-phase electric system on the Midland Railway. Test runs over a level stretch 1,760 yards long between Lancaster and Heysham with a light train weighing 51½ tons, and having 420 H.P., showed that the distance could be covered in 119 seconds, starting from rest, the average speed being therefore 30¼ miles per hour. The acceleration was 25 miles per hour in 22 seconds, and the maximum was 1·91 ft. per second per second, or 1·3 miles per hour per second. This acceleration is rather low, and it is attributed to the low torque applied to the wheels, which can be altered by an alteration in the gear ratio and wheel diameter. The single-phase equipment is heavier by nearly 30 per cent. than a corresponding direct-current system, but the additional weight available for adhesion is frequently an advantage, and, while the figures given represent the actual state of matters so far as the electrical equipment is concerned, the difference to the total weight of the train is only 7½ per cent., so that the energy consumption per train-mile is not so unduly influenced as might at first sight appear to be the case.

**Quarry Bank.**—The U.D.C., as well as the U.D.C. of Brierley Hill, has had under private consideration a further communication from Mr. J. S. Lycett, managing director of the Dudley and Stourbridge Traction Co. relative to the proposed light railway between Brierley Hill, Quarry Bank, and Cradley Heath, but a definite decision on the matter has not yet been arrived at.

**U.S.A.**—There seems to be some prospect of wholesale railway electrification in Chicago, if the ordinance introduced by Alderman Snow, at the City Council, becomes effective. This ordinance, according to *Electric Traction Weekly*, will force every railroad in the city to substitute electricity for steam as motive power within an eight-mile radius of the City Hall by January 1st, 1912. The city relies on an old charter of 1863 and on its police powers in regard to smoke nuisance. The smoke nuisance is caused by the traffic of the terminal and suburban services of 25 or more steam roads entering the city, and by the elevated loop service, which is worked by steam and quite incapable of giving an adequate service under present conditions. The railway companies regard the cost of electrification as prohibitive, and state that electrical working is yet experimental. The cost of electrification of the Illinois Central terminals is estimated at from 40 to 50 million dollars and the cost of complete electrification of all roads at 200 million dollars.

A return of all the railways in the State using 1,200-volt direct-current installations shows that 11 companies are concerned, one operating as much as 90 miles, and all of them operating a total of 420 miles of route. The car equipments in use are all of the four-motor type, with motors of from 50 to 125 H.P. Our contemporary, in giving some details of the installations, draws attention to the small number of sub-stations necessary as compared with 600-volt working; all the equipments are arranged for operating on both 1,200 and 600-volt routes, and the adoption of the system was in each case decided on after considering the rival claims of 600-volt D.C. and single-phase A.C. traction.

## TELEGRAPH and TELEPHONE NOTES.

**Cable Interruptions:—**

| | |
|---|---|
| Tourane-Amoy ... ... ... ... | June 17, 1909 |
| Assab-Perim ... ... ... ... ... | July 8, 1909 |
| Dakar-Conakry ... ... ... ... | Aug. 20, 1909 |
| Balikpapan-Kwandang ... ... ... | Sept. 2, 1909 |
| Cheiksaid-Perim ... ... ... ... | Sept. 15, 1909 |

**Wireless Telegraphy.**—It is reported that the German experiments in telegraphing from Nauen to a steamship *en route* for the Cameroons have proved successful, and that the possibility of establishing wireless communication between Germany and her colonies is regarded as proved.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Alsace.**—November 1st. The municipal authorities of Forbach are inviting tenders for the concession for the establishment and working of an electric tramway in the town.

**Altrincham.**—October 23rd. Electric light installation at the County High School for Girls. Sankey & Cubbon, architects, 4, Chapel Walks, Manchester. (Returnable deposit £1 1s.)

**Australia.**—VICTORIA.—Accumulators for the P.M.G. See "Official Notices" October 1st.

VICTORIA.—Electric lamps for the P.M.G. See "Official Notices" to-day.

MELBOURNE.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" September 24th.

**Austria.**—The Austrian State Railway authorities have just invited tenders for an electric lighting installation at the railway station at Tabor.

**Bray.**—October 19th. 50-B.H.P. Diesel oil engine, and high and low-tension disconnecting boxes, &c., for the U.D.C. See "Official Notices" October 8th.

**Brumby and Frodingham.**—October 16th. Public lighting by electricity for the U.D.C., with 55 50-C.P. lamps, poles, wiring, switches, &c.; direct-current, 220 volts, available. Mr. J. Green, surveyor to the Council, Frodingham, Scunthorpe, Lincs. Returnable deposit, 10s. 6d.

**Cape Town.**—October 19th. Tenders will be received by the Chairman of the Tender Board, Cape Town, for the supply of eight electric motors.

**France.**—October 19th. The municipal authorities of Saint-Mihiel (Meuse) are inviting tenders for the supply of five electric motors and a switchboard.

**Great Western Railway.**—October 18th. Stores, including electrical wires and telegraph apparatus, carbons, &c. See "Official Notices" October 8th.

**Keighley.**—October 16th. Two boiler feed pumps, high-tension switchboard and transformers, 300-KW. motor-generator, and mains for the Electricity Department. See "Official Notices" October 1st.

**Llandudno.**—October 30th. Hand tower-ladder for trimming arc lamps, for the U.D.C. See "Official Notices" to-day.

**Leyton.**—October 26th. Installation of electric light and water heating apparatus at the Canterbury Road Schools, now erecting, for the U.D.C. See "Official Notices" October 8th.

**Lowestoft.**—The Corporation requires a new tank for the hot well, also additional balancers and service cables. Tenders are being invited.

**Manchester.**—October 19th. Steel tie-bars for tramway rails, and bolts and nuts for fishplates, for the Tramways Committee. Specifications from Mr. J. M. McElroy, Tramway Manager.

**Mountain Ash.**—October 25th. Electrical stores for the U.D.C. electricity undertaking. See "Official Notices" October 8th.

**Norway.**—October 25th. The Commercial Intelligence Branch of the Board of Trade is informed by H.M. Consul at Christiania that the Norwegian State Railways have issued a call for tenders for the supply of transformers and electromotors for the Drammen railway works. Tenders, marked "Transformatores, &c.," will be received at Styrelsens Expeditionskontor, Christiania, up to 10 am. on October 25th. Copies of the conditions, specifications and plans, forwarded by H.M. Consul, may be seen by British firms interested on application at the office of the above Branch, 73, Basinghall Street, London, E.C.

**Radcliffe.**—October 27th. Cable for the U.D.C. Electricity Department. See "Official Notices" to-day.

**Rotherham.**—October 23rd. The T.C. has two steam dynamos, 32 KW. each, for disposal. See "Official Notices" September 24th.

**Spain.**—November 2nd. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the working of a telephone system in the town of Oviedo during a period of 15 years.

November 20th.—60 years' concession for constructing and working an electric tramway from Sans to Coll-Blanch (Barcelona). Deposit 1,295 pesetas (£47). Local representation necessary. Tenders to Dirección General de Obras Publicas, Madrid. The Compañia General Tranvias, which has submitted an application, has certain preferential rights.

The municipal authorities of Galaroza (province of Huelva) have lately invited tenders for the concession for the electric lighting of the town during a period of six years.

**Turkey.**—November 30th. The municipal authorities of Broussa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

**Wallasey.**—October 19th. Three miles of electric tramways (overhead line material, poles, wire, ears, &c.) for the U.D.C.; also paper-insulated cables for same. See two "Official Notices" October 8th.

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## CLOSED.

**Belfast.**—The tender of Messrs. Imeson, Finch & Co., Ltd., for two miles of trolley wire, has been accepted by the Belfast Corporation Tramways Department. This is a repeat order.

**Belgium.**—La Société des Clouteries et Trefileries des Flandres, of Gendbrugge, has placed a contract with the Société Union Electrique A.E.G., of Brussels, for the equipment of a large electricity generating station in connection with its works. The plant will comprise two 2,000 H.P. sets of steam turbines and alternators.

**Blackburn.**—The T.C. has affixed the seal to a contract with the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of electric motors; and one with the Wigan Coal and Iron Co., Ltd, for steam and house coal for the electricity department.

**Bradford.**—The T.C. has accepted the tender of Messrs. Clay & Atkinson for eight automatic point-controllers for the tramways, at £440; and that of Messrs. Steel, Peech & Tozer for 200 steel tires for car wheels, at £327.

The City Council is to be recommended to accept the tender of Messrs. Steinthall & Boydell for the provision of a slate switchboard with fittings, at £310; that of the British Thomson-Houston Co., Ltd., for a turbo-generator, at £632 net; and that of Messrs. Collinson Bros. for an electric light installation at the Bradford Moor Branch Library.

**Burnley.**—The E.L. Committee has accepted the following tenders:—

Messrs. I. Frankenburg & Sons, Ltd., for cable required to connect No. 8 and No. 9 generating sets with the switchboard at the electricity works.
Messrs. Simpson Bros., Hapton, for two switches of 2,000 amps. each.
Messrs. Proctor, Ltd., Burnley, for two mechanical stokers for the electricity works.

The Guardians have accepted the tender of Messrs. Carter & Co. for their electrical requirements for the ensuing 12 months.

**Bury.**—The Electricity Committee has given the contract for the switchboard work at the new generating station to Messrs. Ferranti.

**Devon.**—The Committee of Visitors to the County Asylum have accepted the Metallic Seamless Tube Co.'s offer for a 12 months' supply of metallic conduits and fittings and white china wall-plugs.

**Dudley.**—The D.P. Battery Co., Ltd., has secured from the Corporation an order to supply, erect, and maintain for a period of 10 years, a storage battery of 256 cells, of their L S 37 type. This battery is capable of supplying over 1,000 amperes for an hour.

**Glasgow.**—A T.C. committee has recommended acceptance of the following:—

Additional piping and valves, Pinkston power station.—Babcock & Wilcox, Ltd.
C.C. wire.—British Insulated and Helsby Cables, Ltd.

The Electricity Sub-committee on Works recommends that the offers of the British Thomson-Houston Co. (£211) and Messrs. Ferranti, Ltd. (£270), for high-tension switchgear be accepted. Messrs. Appleby's offer (£154) for the provision and erection of a crane at Port Dundas works was also recommended for acceptance.

**London.**—L.C.C.—The Highways Committee reports that during the summer recess it received and accepted the following tenders:—

(*a*) Manufacture, delivery and laying of high-tension cables:—

| | | |
|---|---|---|
| **Western Electric Co.** | (accepted) | £4,757 |
| W. T. Henley's Telegraph Works Co., Ltd. | | 4,818 |
| British Insulated and Helsby Cables, Ltd. | | 4,873 |
| Siemens Bros. & Co., Ltd. | | 4,888 |
| Johnson & Phillips, Ltd. | | 4,937 |
| Callender's Cable and Construction Co., Ltd. | | 4,958 |
| W. T. Glover & Co., Ltd. | | 4,976 |
| Robert W. Blackwell & Co., Ltd. | | 5,073 |
| The Yorkshire Cable Co., Ltd. | | 5,438 |
| Edward Le Bas & Co. (incomplete tender) | | 7,031 |

Estimate of chief officer of tramways, comparable, £5,000.

(*b*) Manufacture, delivery and laying of low-tension cables:—

| | | |
|---|---|---|
| Union Cable Co., Ltd. (foreign manufacture) | | £31,997 |
| **British Insulated and Helsby Cables, Ltd.** | (accepted) | 32,000 |
| W. T. Henley's Telegraph Works Co., Ltd. | | 32,403 |
| Western Electric Co. | | 32,418 |
| Callender's Cable and Construction Co., Ltd. | | 32,769 |
| Johnson & Phillips, Ltd. | | 32,990 |
| W. T. Glover & Co., Ltd. | | 33,457 |
| Siemens Bros. & Co. | | 34,327 |
| Robert W. Blackwell & Co., Ltd. | | 34,569 |
| The Yorkshire Cable Co., Ltd. | | 37,711 |

Estimate of chief officer of tramways, comparable, £38,000.

(*c*) Supply and delivery of tramway feeder pillars:—

| | | |
|---|---|---|
| **British Insulated and Helsby Cables, Ltd.** | (accepted) | £1,117 |
| W. Boydell & Sons, Ltd. | | 1,198 |
| J. H. Tucker & Co. | | 1,230 |
| Johnson & Phillips, Ltd. | | 1,239 |
| Edison & Swan United Electric Light Co., Ltd. | | 1,274 |
| Ferranti, Ltd. | | 1,275 |
| Robert W. Blackwell & Co., Ltd. | | 1,289 |
| British Westinghouse Electric and Mfg. Co., Ltd. | | 1,295 |
| Universal Electrical Manufacturing Co., Ltd. | | 1,313 |
| Whipp & Bourne | | 1,322 |
| W. Lucy & Co., Ltd. | | 1,345 |
| Spagnoletti, Ltd. | | 1,357 |
| Western Electric Co. | | 1,385 |
| Siemens Bros. & Co., Ltd. | | 1,395 |
| Estler Bros. | | 1,414 |
| Tetley & Co. | | 1,416 |
| W. T. Glover & Co., Ltd. | | 1,447 |
| Electric Construction Co., Ltd. | | 1,471 |
| Tramway Supplies, Leeds | | 1,603 |
| Société Anonyme (Jones & Co.), Brussels | | 1,675 |
| Callender's Cable and Construction Co., Ltd. | | 1,698 |
| Alfred Wiseman, Ltd. | | 1,743 |
| Veritys Ltd. | | 1,962 |
| General Electric Co., Ltd. | | 2,047 |

Estimate of chief officer of tramways, comparable, £1,580.

(*d*) Reconstruction of the tramways from Beresford Square to Nile Street—Supply of special work:—

| | | |
|---|---|---|
| **Hadfield's Steel Foundry Co., Ltd.** | (accepted) | £502 |
| Edgar Allen & Co., Ltd. | | 543 |

Estimate of chief engineer, comparable, £520.

(*e*) Reconstruction of Highgate Hill tramways—Supply of special slot-rails:—

| | | |
|---|---|---|
| North-Eastern Steel Co. | | £1,995 |
| **Frodingham Iron and Steel Co., Ltd.** | (accepted) | 2,036 |
| Walter Scott, Ltd., Leeds | | 2,106 |

In connection with the reconstruction of Highgate Hill tramways, the tenders for roadwork and platelaying were as follows:—

| | Tramway work. | Paving works for street widenings. | Total. |
|---|---|---|---|
| **A. N. Coles,** Paddington, W. (accepted) | £16,655 | £2,447 | £19,101 |
| W. Manders, Leyton | 16,400 | 3,295 | 19,695 |
| R. C. Brebner & Co., Edinburgh | 16,743 | 3,173 | 19,920 |
| G. Percy Trentham | 17,089 | 2,854 | 19,943 |
| Dick, Kerr & Co., Ltd. | 18,074 | 3,237 | 21,312 |
| John Mowlem & Co., Ltd. | 19,302 | 3,442 | 22,744 |
| Bower Bros., Shepherd's Bush, W. | 23,529 | 3,184 | 26,713 |
| Chief engineer's estimate, comparable | 16,813 | 3,239 | 20,052 |

The lowest tender for the tramway work was that submitted by Mr. W. Manders, but the tender of Mr. A. N. Coles was the lowest in the total amount for the tramway work and street-widening paving works, and, acting in conjunction with the Improvements Committee, this latter tender, amounting to £19,101, was accepted.

Tenders for steam, &c., piping, valves, water tanks, &c., for the final portion of Greenwich generating station:—

| | | |
|---|---|---|
| **Staveley Coal and Iron Co., Ltd.** | (accepted) | £7,345 |
| Edward Le Bas & Co. | | 7,642 |
| John Spencer, Ltd. | | 7,746 |
| Foster Bros., Ltd. | | 7,760 |
| Babcock & Wilcox, Ltd. | | 7,768 |
| Railway and General Engineering Co., Ltd. | | 8,000 |
| Stewarts & Lloyds, Ltd. | | 8,011 |
| James Oakes & Co. | | 8,151 |
| E. Bennett & Son, Ltd. | | 8,174 |
| John Wilson & Co. | | 8,440 |
| Shelby Manufacturing Co. | | 9,268 |
| Westwood & Wrights, Brierley Hill (incomplete tender) | | 6,873 |

Estimate of chief officer of tramways, comparable, £9,000

The tender of Mr. H. L. Holloway, for erecting foundations for the installation of two 1,500-KW. rotary converters at the Elephant and Castle sub-station was accepted, at £743.

For the provision of choke coils, to be fitted to 25 of the existing motor-generators at the Council's tramways sub-stations, the tenders were:—

| | | |
|---|---|---|
| **Electric Construction Co., Ltd.** | (accepted) | £1,098 |
| Johnson & Phillips, Ltd. | | 1,437 |
| Spagnoletti, Ltd. | | 1,606 |
| Ferranti, Ltd. | | 1,761 |
| " " (alternative) | | 1,768 |
| Dick, Kerr & Co. | | 1,923 |
| " " (alternative) | | 1,398 |
| British Westinghouse Electric and Mfg. Co. | | 2,706 |
| " " " " | (1st alternative) | 2,611 |
| " " " " | (2nd alternative) | 1,831 |
| " " " " | (3rd alternative) | 1,726 |

Estimate of chief officer of tramways, comparable, £1,500

For 1,000 destination boards, fitted with end protection plates, the tenders were :—

| | |
|---|---|
| J. Challis, Ltd. .. .. .. .. .. .. (accepted) | £217 |
| Equipment and Engineering Co. .. .. .. .. .. .. | 275 |
| Hurst, Nelson & Co., Ltd. .. .. .. .. .. .. | 300 |
| United Electric Car Co., Ltd. .. .. .. .. .. | 392 |
| " " " " (alternative tender) .. .. | 500 |

The following appears in an entry regarding the contract placed in 1908 with Messrs. Mountain & Gibson, Ltd., for the supply of six stores transport vehicles required in connection with the Council's tramways :—

We reported on July 27th-28th that a receiver of the company had been appointed on behalf of the debenture-holders, and the Council on that date decided that arrangements should be made for each delivery made by the receiver to be regarded as the subject of a separate contract; and that payment for each such delivery should be made to the receiver without the exercise of any right of set-off on the part of the Council for any claims the Council may have in respect of any of the said deliveries of contracts, but otherwise without prejudice to any claims the Council may have against the company under the contracts generally. One of the terms of the Council's contract is that Mountain & Gibson shall indemnify the Council in respect of all claims arising under patent rights. Notice has now been received from Dick, Kerr & Co., Ltd., claiming patent rights in respect of part of certain electrical equipments which have apparently been supplied to the Council by the British Westinghouse Co., Ltd. The latter company, as sub-contractors to Mountain & Gibson, are also supplying the electrical equipments for the stores transport vehicles, upon the terms of the Council's contract with Mountain & Gibson. The receiver has asked the Council to accept the British Westinghouse Co.'s indemnity direct against any claims under patent rights in respect of these electrical equipments, so as to absolve him from the stringent provisions of the indemnity clause in the Council's contract, otherwise he states that he will be unable, in view of the claim made by Dick, Kerr & Co., Ltd., to proceed with the contract. We see no objection to this course, and we have accordingly authorised the transfer of the indemnity.

Battersea.—We learn from Messrs. Stegmann & Co. that in the recent placing of contracts by the Borough Council, their tender was accepted for arc lamps as well as for the motors.

**Oldbury.**—The U.D.C. has accepted the tender of the Birmingham and Midland Tramway, Ltd., for an overhead cable to the sewage-disposal works, at £99, and for poles, wiring and lamps for lighting the works, at £75.

**Plymouth.**—The Education Committee received the following tenders for the installation of electric light at Regent Street school :—

| | |
|---|---|
| David Sale .. .. .. (accepted) | £124 |
| W. G. Heath & Co. .. .. .. .. | 135 |
| Lord & Shand .. .. .. .. .. | 136 |
| W. J. Corse & Co. .. .. .. .. | 140 |

**Rotherham.**—The T.C. has accepted the tender of Messrs. Reavell & Co., at £405, for a motor-compressor, to duplicate the one at present in use adjoining the electricity station. The Council has further accepted the tender of Callender's Cable and Construction Co., Ltd., at £2,187, for the annual supply of cables; also the tender of the Reason Manufacturing Co. for the annual supply of electricity meters, and the tender of the Sheepbridge Coal and Iron Co. for the annual supply of coal (Grapwell), at 5s. 4½d. per ton. For engineering stores for the tramways department, the tenders of the following have been accepted :—

India-Rubber and Gutta-Percha Telegraph Works, Ltd.; Smith Bros., Ltd. (Rotherham); Joseph France; London Phosphor Copper and Bronze Co.; Vacuum Oil Co.; Robert Young & Co.; R. D. Nicol & Co.; R. Ingham Clark & Co.; Griffiths Bros. & Co.; Harland & Son; L. Kearsley & Co., Ltd.; Hindsford Foundry Co.; Alfred Wiseman; British Westinghouse Co.; Sanderson Bros. & Newbould, Ltd.; Tasker's Engineering Co.; Tempered Spring Co.; Tramway Supplies, Ltd.; General Electric Co.; L. Andrews & Co.; R. Bell & Co.; F. W. Crookes; W. Taylor & Sons; H. Garnett & Co., Ltd.

**St. Helens.**—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for the supply and laying of high-tension mains for the supply of current for the Sutton district; and that of the British Westinghouse Electric and Manufacturing Co., Ltd., for high-tension plant.

**Stretford.**—The U.D.C. has accepted the tender of the Vulcan Motor Co. for a 16-h.p. petrol-motor arc lamp wagon, with hydraulic lift, at £385. It has further accepted the tender of Messrs. J. Hodgkinson, Ltd., for a coal transporter, weighing, feeding and storage plant for the electricity undertaking, at £682.

**Wallasey.**—The U.D.C. on October 7th considered a recommendation of the Tramways Committee to accept the tender of the Brush Electrical Engineering Co. for 10 new cars, of the "long wheel-base truck" design, by which it is hoped to obviate the jolting and pitching which has been the cause of so many complaints by passengers on this line. After considerable discussion, the Committee's recommendation was approved.

**West Bromwich.**—The T.C. has accepted the tender of the Electric Construction Co., Ltd., Wolverhampton, for a feeder booster.

**West Ham.**—The Guardians have accepted the Metallic Seamless Tube Co.'s offer for a 12 months' supply of metallic conduits and fittings, and white porcelain counterweights and accessories.

**Yarmouth.**—The T.C. has accepted the tender of Messrs. Myers, Rose & Co., Ltd., for 2,000 tons of Derbyshire fine slack coal, at 8s. 7d. per ton f.o.r. Yarmouth, for use at the electricity works.

## FORTHCOMING EVENTS.

**Junior Institution of Engineers.**—Friday, October 15th. At 7 p.m. Visit to the Model Engineer Exhibition, Horticultural Hall, Westminster.

Saturday, October 23rd.—At 7 p.m. At Caxton Hall, Westminster. Conversazione.

**Institution of Mechanical Engineers.**—Friday, October 15th. At 8 p.m. At the Institution House, Storey's Gate. Paper on "Heat Transmission," by Prof. W. E. Dalby.

**Physical Society.**—Friday, October 22nd. At 5 p.m. At the Royal College of Science, South Kensington, S.W. Paper "On Cadmium Amalgams and the Normal Weston Cell," by Mr. F. E. Smith, and other papers.

**Institution of Electrical Engineers (Manchester Section).**—Friday, October 22nd. At 7.30 p.m. At Midland Hotel, Manchester. Opening meeting for the session. Address by the chairman, Mr. S. J. Watson. A smoking concert to follow. [Other meetings will be held at the Physical Laboratory of the Manchester University.]

**Electro-Harmonic Society.**—Friday, October 22nd. At 8 p.m. At the King's Hall, Holborn Restaurant. First smoking concert of the season.

## THE ELECTRICAL ENGINEERS
### (LONDON DIVISION).

The following orders are issued for the week ending October 23rd, 1909 :—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, October 18th.—"A" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Tuesday, October 19th.—"B" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Wednesday, October 20th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, October 21st.—"C" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Friday, October 22nd.—"D" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

(Signed) P. H. Campbell,
Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

## NOTES.

**P. & O. Batti-Wallahs' Society.**—The Birmingham Local Section of this Society opened their social gatherings for this season with a smoking concert on Thursday, October 7th, at the Grand Hotel, Birmingham. Over 70 members and friends were present. The programme was contributed to chiefly by members, and a most enjoyable evening was spent. The chairman for the evening—Mr. J. P. Kemp—who is also chairman of the Local Section, in his remarks foreshadowed many other pleasant evenings to follow, the next being a Bohemian concert (ladies) on November 5th, to be held in the Grosvenor Room, Grand Hotel.

**The Electro-Harmonic Society.**—The first smoking concert of the twenty-fourth season, 1909-10, will be held in the King's Hall, Holborn Restaurant, on Friday evening next, October 22nd, commencing at 8 o'clock. The artists for the evening are Mr. Alfred Heather, Mr. Thorpe Bates, and the Chandos Part Singers; Master Lloyd Chandos, cornet solos; Mr. Bromley Carter, humorous dialect songs; Dorswami, Royal Indian Court musician; Mr. Barclay Gammon, humorous sketch.

**Football Notes.**—South Metropolitan Electric Football Club.—On Saturday last a match was played at Hither Green between the South Metropolitan Co.'s employés (Works *v.* Office and Rest), which, after a very good game, resulted in a win for the Works by 6 goals to 2.

**Inquiries.**—A correspondent wishes for the name and address of the makers of the "Daylight" arc lamp.

A correspondent wishes to know if tin has been, or can be, smelted direct from the ore with the electric furnace.

We are asked for the name of the maker of "Bauer" radiators.

**Institution Notes.**—Automobile Engineers.—Mr. J. S. Irving (Daimler Motor Co.) read a paper on "Electric Ignition on Motor Cars," at a meeting of the Coventry Graduates' Section of Automobile Engineers on October 4th. In the course of his paper, Mr. Irving said that when a single coil was used in conjunction with a high-tension distributor, it was of the greatest importance that the current in the primary should never be allowed to fall to a value near what had been called the "critical value" for the particular coil. In his experience, when the trembler was adjusted for any given voltage so that the note produced was pure and clear, a very slight decrease in current would cause the timing to be defective, owing to the region of the critical current being approached. Hence with the normal current flowing it was advisable to adjust the trembler to give a somewhat harsh and shrill sound, for then the current might be considerably reduced before

the critical value was reached. When selecting a coil, regularity of working of the trembler for considerable variation of current was of more importance than length or fatness of spark. Further, a coil taking a small current was to be preferred to one taking a large current, since the trouble with the adjustment of the trembler blade would be decreased owing to the reduced sparking at the platinum points. Except for the fact that the engine could not be started on the switch, the plain coil with a rapid break on the half-time shaft was preferable to a trembler coil, since over a very large range of current—in fact, whenever the current was large enough to cause the passage of a spark in the cylinder—the timing was exactly the same. The advantage of a trembler might be retained by a switch so arranged that the trembler might be cut out, allowing the coil to act as a plain coil, a second condenser being provided. This system was adopted with the Bosch and dual ignition. He had experimented with a single coil and distributor working in conjunction with a single firing point on a shaft working at twice engine speed, instead of half-engine speed, and found a great improvement in the steadiness of the running of the engine, due to the firing point occurring at exactly the same piston position for every cylinder, so that the power of the explosion in each cylinder was alike, whereas with the ordinary type of segmented commutator used for multi-cylinder engines, there was practically a difference of sparking point in each cylinder, tending to uneven running. Mr. J. S. Napier, during the discussion, said he had had to design a car that was going to the South Pole, and thought of using dry cells for the ignition, because, if dry, they could not freeze. A member of the expedition had since told him that the dry cells were absolutely of no use, as a small quantity of liquid had to be put in, and when once they were used they froze hard. Consequently magneto ignition had to be resorted to, both types, fortunately, having been fitted.

Institution of Mining Electrical Engineers.—The general meeting of the Institution at Sheffield, on October 2nd, was well attended. The President, Mr. Wm. Maurice, said that the Council had been engaged in drawing up a "memorandum" specifying the objects for which the Institution was formed, and articles of association under which it purposed working. As regarded the objects of formation, the two principal clauses were expressed thus: (*a*) To consider means for minimising the risks attending the application of electricity to the industry of mining, and to promote the adoption of approved methods and devices tending to increase safety. (*b*) To promote the general advancement of electrical science in its applications to the industry of mining; to facilitate the exchange of information and ideas on this subject amongst the members of the Institution and otherwise; and, generally, to extend the experience, increase the efficiency, and elevate the status, of those engaged in such applications. Power would be taken to form a benevolent society for the assistance of necessitous members. The qualifications for membership of the Institution had been designed to admit everyone who was interested in its objects, while, at the same time, providing for the establishment of a special class for mining electricians. Specifically, membership of the Institution would consist of honorary members, honorary corresponding members, diploma members, associates and students. The President explained the qualifications of the respective classes, and stated that the General Council of the Institution (which was composed of representatives from branches) would conduct the management of affairs, the branches themselves being the bodies upon which all the practical work, reading of papers, holding of monthly meetings, &c., would devolve. The working arrangements for these branches were being pushed forward, and the regular meetings would commence, the Council hoped, in November. A London branch was in course of formation for the convenience of consulting mining electrical engineers, and of that large body of men associated with such work who were constantly engaged abroad but with London as their centre of operations. The secretary of this new branch was Mr. Reginald Krall, of Balfour House, Finsbury Pavement, E.C. With reference to the numerous accidents which had happened during the past few years in the use of electricity in mines, alarm had been expressed in certain quarters which had tended to suspend electrical development. The Council, therefore, had determined to appoint a small Committee to inquire into the causes and means of preventing accidents arising out of the use of electricity in coal mines, and to report at, it was hoped, the December meeting.

South Staffs. and Warwickshire Institute of Mining Engineers.—Mr. H. Johnstone (Inspector of Mines for South Staffordshire), the new president, on Monday addressed the Institute on the subject of accidents in coal mines, and stated that fine dry coal dust could be ignited by even a small electric arc.

Sheffield Society of Engineers.—Mr. H. O. Wraith, M.I.E.E., recently delivered a lecture before the society on the Home Office Regulations for the use of electricity in factories.

**Electrical Firms and Airships.**—The Siemens-Schuckert Works recently stated that the company had not taken up the construction of airships as a branch of business, but rather that the airship now building represents a study on a large scale which the company is making in the interest of the military authorities and for the purpose of promoting the problem of technical aviation at its own risk. In these circumstances, the company has no object in expediting the completion of the airship, the principal consideration in connection with which is the testing as fully and as far as possible of all its features before commencing actual trials.

**McGill University, Montreal.**—Mr. Carnegie, according to the *Times*, has given £20,000 to the general funds of this University.

**Our Canals.**—The Royal Commission on Canals and Waterways—by the way, we had almost forgotten that it was still sitting—expects to present its final report on the canals and inland navigation of Great Britain in the course of a few months.

**Legal.**—Z Electric Lamp Manufacturing Co., Ltd., *v.* Marples, Leach & Co., Ltd.—The Master of the Rolls and Lords Justices Moulton and Farwell had before them, on Tuesday last, an appeal by the plaintiff company, from the refusal of Mr. Justice Warrington in this Chancery action to order the defendants to give further and better particulars of their objection to the plaintiffs' patent. Mr. Colefax, in support of the appeal, said that the plaintiffs brought the action against the defendants for alleged infringement of their patent, and among other objections, defendants said that the plaintiffs' alleged invention was not proper subject matter for letters patent. What the plaintiffs wanted to know was against which of their claims that objection was urged.

Lord Justice Moulton: You are not entitled to particulars of public general knowledge.

Mr. Colefax: I want to know whether my friend is relying upon public general knowledge, and if so, I ought to know what it is he alleged against me.

Lord Justice Moulton said that the defendants had set out all the anticipations they relied upon.

Without calling upon counsel for the respondents, their Lordships dismissed the appeal.

London Electrobus Co., Ltd.—In the Creditors' Winding-up Court, on Wednesday, October 13th, the matter of the London Electrobus Co., Ltd., was mentioned. The petitioners were Messrs. Pritchetts & Gold, Ltd. When the case was called there was no appearance for the petitioners. Mr. Justice Swinfen Eady dismissed the petition.

**Appointments Vacant.**—The West Ham tramways manager has been authorised to appoint an additional general assistant at a salary of £100, rising to £120. Switchboard attendant for Newport, Mon. (25s.). See our advertisement pages to-day.

**A Peculiar Phenomenon.**—The following amusing comment on a recent letter has been mysteriously precipitated upon our desk:—

"I am much interested in the curious phenomenon described by Mr. Alfred Barnes in your issue of last week, but as he does not state the periodicity of the alternator, whether the exciter was rope-driven or direct-coupled, or whether he believes in Tariff Reform, even I can only surmise as to the cause of the strange effect.

"S. P. Thompson in his masterly work, "Electricité pour les Enfants," mentions the strange case of a man who received a strong shock by touching the opposite poles of a galvanic battery, and states that this could have been avoided by having the terminals covered with cotton wool. I would recommend this method to Mr. Barnes, or failing it, the whole machine should be dipped in a solution of sal-ammoniac and hung up to dry, the bearings being afterwards carefully wiped.

"S. Holmes.

"Baker Street, London."

"My poor friend Holmes has suffered so much of late from sleeplessness and from his practice of injecting morphia, that I am afraid his advice cannot be entirely relied upon.

"Watson, M.D."

**Marconi's Wireless Telegraph Co.**—As we go to press we have received a letter from the above-named company, pointing out that the recent agreement with the Post Office mainly concerns the Marconi International Marine Communication Co., Ltd, the parent company being interested principally as a shareholder. None of the stations belonging to Marconi's Wireless Telegraph Co., Ltd., are included in the agreement, nor does it affect the trans-oceanic business and stations of the company. A very small portion of the business of the International Co. has been transferred to the Post Office, and the manufacturing business of the Wireless Co. will be beneficially affected. The damage done to the Glace Bay station by fire was covered by insurance, and it is hoped that the trans-Atlantic service will be reopened early in the new year.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*

**Central Station Officials.**—On the occasion of his marriage, Mr. R. L. Torpy, deputy borough electrical engineer, Wimbledon, was presented with a canteen of plate and cutlery by his brother officers; also with a dining room clock fitted with chimes, by the employés of the Electricity Department.

At a special private meeting of the Morecambe T.C. on Monday, a letter was read from Mr. W. H. Hall, electrical engineer, resigning his position. It was resolved that the resignation be accepted, and that Mr. R. Wright, an engineer who has just completed a special report on the Corporation's undertaking, be paid 55 guineas for his services and be retained as consulting

engineer for two years. The appointment of engineer will be advertised, the salary being £150 per annum.

**General.**—On Wednesday, 29th ult., a farewell dinner was given at the Midland Hotel, Manchester, in honour of Mr. K. K. von Krogh, who has resigned his position with the British Westinghouse Co. to engage in consulting engineering work in Norway, his native country. Mr. Newcomb Carlton, managing director of the British Westinghouse Co., acted as toastmaster. The general manager of works, the general sales manager, and some 25 other prominent members of the staff were present. The chairman, in a eulogistic speech, paid tribute to the excellent work accomplished by Mr. Krogh, and said that if consulting engineering should not prove as attractive or lucrative as anticipated, he would always be welcomed back at Trafford Park. In a number of subsequent speeches complimentary reference was made to the success attending his able co-operation with all branches of the organisation. Altogether a very enthusiastic send-off was accorded him. Mr. Krogh's business associates have presented him with several valuable mementoes, and his wide circle of English friends will wish him every success. Mr. Krogh, who has been with the British Westinghouse Co. about five years, received his technical training in Germany, at the Technical High School, Darmstadt. Here he was for one year assistant lecturer, and graduated as Diplom-Ingenieur in 1899. After serving his term of military service in Norway, he became associated for a short time with the British Schuckert Co. in London, and subsequently with Messrs. Siemens & Halske, of Berlin. In 1900 he joined the A.E.G. in Berlin, commencing on the testing bed, and afterwards reorganising the transformer department, where, as designer and superintendent, he did pioneer work. In 1904 he accepted a position with the British Westinghouse Co. in the control department, and shortly afterwards was appointed superintendent of the transformer department. His sound technical knowledge and capacity as an organiser brought him rapid promotion, and within two years he was also appointed to the control of the arc lamp, insulating and winding, and motor and punch departments. Mr. Krogh has joined in partnership Jacob Prebensen Nissen, of Nedre Slotsgade 15, Christiania, who has for several years been prominently identified as consulting engineer with several large and important high-tension power transmission plants in Norway. The firm will in future be known as Nissen and von Krogh, and in addition to extensive power transmission work, will engage largely in industrial and municipal undertakings. They will also have a fully-equipped laboratory for carrying out electrical testing of all kinds.

The Board of Trade has appointed Dr. Alexander Russell, principal of the Electrical Standardising, Testing and Training Institution, to be an electrical inspector under the Croydon Corporation Electric Lighting Order, 1891, in succession to Mr. Hugh Erat Harrison, who died in August last.

Mr. William T. Taylor, M.I.E.E., is expected to arrive in London about October 22nd. He has just completed his two years' agreement with the Kashmir Government in connection with the erecting and operating of their hydro-electric system. Mr. Taylor is going into business for himself. His address will be "Glendower," 76, Greenham Road, Muswell Hill, London.

Mr. W. P. Miller, A.M.I.E.E., has severed his connection with the contract department of Messrs. Crompton & Co., Ltd., Salisbury House, London, E.C., and has entered into partnership with Mr. Lewis Radmore, of Messrs. Radmore & Co., 25-26, Ludgate Hill, Birmingham, where he will attend to the export engineering business, and will also undertake general inspection and testing work in the Midlands. Electrical manufacturers are invited to forward lists, &c.

Mr. James Healey, of Helsby, having terminated his engagement with Messrs. Hutchins & Co., Ltd., of Harlesden, London, N.W., owing to their having sold their business, has now taken up an appointment with the General Electric Co., Ltd., at Peel Works, Salford.

The staff of Messrs. Laurence, Scott & Co., manufacturing electrical engineers, of Norwich, have presented a silver-plated tea service to Mr. W. H. Davies, chief of the winding department, on his completion of 25 years' service with the firm.

It is announced in the *Times* that Mr. H. H. Mothersole, of London, has been appointed secretary of the North of England Engineering Employers' Association, in Newcastle-on-Tyne.

Mr. H. Ellis Thompson, till lately manager for Messrs. Donnison, Sillem & Co., of Great Portland Street, W., has been appointed chief engineer for Messrs. Tredegar & Co., of Westminster, St. Albans and Bow.

**Obituary.**—The death of Mr. Milo G. Kellogg, founder of the Kellogg Switchboard and Supply Co., U.S.A., at the age of 60, is reported in *Telephony*. Mr. Kellogg was associated with Elisha Gray and E. M. Barton in the formation of the Western Electric Manufacturing Co. in 1872 for the exclusive manufacture of the Bell telephones, and was for a long period one of the chief officers of the Western Electric Co., its successor. He was a noted inventor of telephonic apparatus, and in one week was granted no fewer than 125 United States patents, the largest number ever issued at one time to any person.

The death of Mr. Hugh Blackburn, Emeritus Professor of Mathematics at Glasgow, occurred on the 11th inst., at the age of 86 years.

We regret to learn of the death, which occurred at Kensington on 11th inst., of Dame Elizabeth Anne, widow of Sir Samuel Canning, of submarine cable fame, who passed away only last year. Lady Canning was 80 years of age.

The funeral of Mr. C. J. Robertson, whose death we briefly announced in our last issue, took place at Ealing on Saturday last, and the interment at St. George's Cemetery took place in the presence of a large number of friends and workers from the Robertson and Osram lamp factories, and societies with which he was connected. Mr. Robertson was associated with Mr. St. G. Lane-Fox from 1879 to 1881, and therefore was interested in lamp-making "from the beginning"; he also was in control of the manufacture of the Gatehouse and Bernstein lamps, until the establishment of the Edison monopoly compelled the closure of the factories. Mr. Robertson next equipped and carried on a number of factories on the Continent, and on the expiration of the Edison patents, he returned to found the Robertson Lamp Works at Brook Green, in association with Mr. G. Byng, and the General Electric Co., at which works he remained as technical director and one of the managers until his death.

## CITY NOTES.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Para Electric Railways and Lighting Co.—£700,000 5 per cent. first debenture stock.

And to allow the following securities to be quoted in the Official List—

Para Electric Railways and Lighting Co.—70,000 ordinary shares of £5 each, fully paid; and 14,000 6 per cent. cumulative preference shares of £5 each, fully paid.

Shawinigan Water and Power Co.—Further issue of $61,000 5 per cent. consolidated first mortgage bonds.

**Drake & Gorham, Ltd.**—The directors' report for the year ended June 30th, 1909, states that after payment of all charges, including bonuses due to staff, there remains a net profit of £2,282, which, with the sum of £1,328 brought forward from the previous year, makes a total of £3,610, which it is proposed to appropriate as follows:—A dividend at the rate of 2½ per cent. per annum, £3,125, carrying forward £485. The work carried out by the London office during the past year compares very favourably with the previous twelve months, and the agency business in Osram and tantalum lamps continues to expand; the orders, however, for installation work in the Northern district have, unfortunately, considerably decreased, and this is attributed to the depression prevailing within the last eighteen months, and the reduction in dividend is mainly due to this cause. A satisfactory feature of the past year is the large amount of work executed for old clients in connection with the modernising and extension of existing installations.

**Indo-European Telegraph Co., Ltd.**—The directors have declared an interim dividend for the half-year ending June 30th last at the rate of 5 per cent. per annum, free of income-tax, payable on and after November 1st. The transfer books will be closed from 18th to 30th inst.

**Germany.**—The Rheydt Kabelwerk Gesellschaft, of Rheydt, is declaring a dividend of 8 per cent. for the last financial year. In the preceding 12 months the shareholders received no dividend.

**Direct United States Cable Co., Ltd.**—The board have resolved upon the payment of an interim dividend of 4s. per share, free of income-tax, being at the rate of 4 per cent. per annum for the quarter ending September 30th.

**Stothert & Pitt, Ltd.**—The directors recommend a dividend of 6 per cent. on the ordinary shares for the past year, placing £500 to reserve and carrying forward £1,587.

**Western Union Telegraph Co., Ltd.**—This company has published its quarterly report to September 30th, 1909, from which it appears that after providing for the usual capital calls for interest and dividends, there remains a surplus of $18,088,729.

**Rosario Electric Co., Ltd.**—The directors' report for the year ended June 30th, 1909, shows a balance at the credit of profit and loss account, after making provision for depreciation of buildings, plant, &c., of £35,014, plus £6,549 brought forward, making £41,563. The directors propose a dividend of 5s. per share on 14,513 ordinary shares (making 8 per cent. for the year), and an addition to the reserve of £15,000, leaving £9,282 to be carried forward. The lamps connected and power supply expressed in 8 c.p. were:—June 30th, 1907, 123,318; June 30th, 1908, 151,167; June 30th, 1909, 195,705. The receipts for lighting and power were:—June 30th, 1907, £64,313; June 30th, 1908, £73,131; June 30th, 1909, £91,338. The directors have ordered a 1,000 kw. steam dynamo to cope with the steadily increasing demand for both lighting and power. A more favourable price for coal has beneficially affected the results of the year's working, and the new condensing plant has reduced the amount of coal per unit.

**Oriental Telephone and Electric Co., Ltd.**—The directors have declared the following interim dividends:—3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax, and 3 per cent. on the ordinary shares, free of income-tax. The warrants will be posted on the 30th inst. The share transfer books will be closed from the 14th to the 27th inst.

**Callender's Cable and Construction Co., Ltd.**—The directors have declared an interim dividend of 5s. per share on the ordinary shares.

## MARKET QUOTATIONS.

### Wednesday, October 13th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| a Acid, Hydrochloric | per cwt. | 5/- | .. |
| a „ Nitric | „ | 22/- | .. |
| a „ Oxalic | „ | 28/- | .. |
| a „ Sulphuric | „ | 5/6 | .. |
| a Ammoniac, Sal | „ | 42/- | .. |
| a Ammonia, Muriate (crystal) | per ton | £29 | .. |
| a „ „ | „ | £30 | .. |
| a Bleaching powder | „ | £5 10 | .. |
| a Bisulphide of Carbon | „ | £18 | .. |
| a Borax | „ | £16 | .. |
| a Ferro-Silicon (50 %) | „ | £11 | .. |
| a Copper Sulphate | „ | £18 10 | .. |
| a Lead, Nitrate | „ | £26 10 | .. |
| a „ White Sugar | „ | £23 10 | .. |
| a „ Peroxide | „ | £32 | .. |
| a Methylated Spirit | per gal. | 2/6 | .. |
| a Potassium, Bichromate, in casks | per lb. | 3½d. | .. |
| a Potash, Caustic (75/80 %) | per ton | £20 | .. |
| a „ Chlorate | per lb. | 3½d. | .. |
| a „ Perchlorate | „ | 3½d. | .. |
| a Potassium, Cyanide | „ | 7d. | .. |
| a Shellac | per cwt. | 75/- | .. |
| a Sulphate of Magnesia | per ton | £4 10 | .. |
| a Sulphur, Sublimed Flowers | „ | £6 10 | .. |
| „ Recovered | „ | £5 10 | .. |
| a „ Lump | „ | £5 | .. |
| a Soda, Caustic (white 70 %) | „ | £10 15 | .. |
| a „ Chlorate | per lb. | 3⅝d. | .. |
| a „ Crystals | per ton | £3 5 | .. |
| a Sodium Bichromate, casks | per lb. | 3d. | .. |
| a „ Cyanide (basis 100 %) | „ | 7d. | .. |
| **METALS, &c.** | | | |
| b Aluminium Ingots, in ton lots | per ton | £75 | £5 dec. |
| b „ Wire, in ton lots | „ | £112 | .. |
| b „ Sheet, in ton lots | „ | £120 | .. |
| p Babbitt's metal ingots | „ | £50 to £136 | .. |
| c Brass (rolled metal 2" to 12" basis) | per lb. | 7⅞d. | .. |
| c „ Tube (brazed) | „ | 8⅜d. | .. |
| c „ „ (solid drawn) | „ | 7¼d. | .. |
| c „ Wire, basis | „ | 6¼d. | .. |
| c Copper Tubes (brazed) | „ | 8⅜d. | ½d. inc. |
| c „ „ (solid drawn | „ | 8⅜d. | ½d. inc. |
| g „ Bars (best selected) | per ton | £71 | £1 dec. |
| g „ Sheet | „ | £71 | £1 dec. |
| g „ Rod | „ | £71 | £1 dec. |
| e „ (Electrolytic) Bars | „ | £60 10 | .. |
| e „ „ Sheets | „ | £77 | .. |
| e „ „ Rod | „ | £65 10 | .. |
| e „ „ H.C. Wire | per lb. | 7¾d. | .. |
| f Ebonite Rod | „ | 8/3 | .. |
| f „ Sheet | „ | 3/- | .. |
| n German Silver Wire | „ | 1/6 | .. |
| h Gutta-percha, fine | „ | 5/6 to 6/6 | .. |
| h India-rubber, Para fine | „ | 8/9 | 4d. dec. |
| l Iron Pig (Cleveland warrants) | per ton | 51/9 | 9d. dec. |
| l „ Wire, galv. No. 8, P.O. qual. | „ | £14 | .. |
| g Lead, English Ingot | „ | £13 10 to £13 15 | inc. |
| m Manganin Wire No. 28 | per lb. | 6/6 | .. |
| q Mercury | per bot. | £7 12 6 | .. |
| d Mica (in original cases) small | per lb. | 6d. to 1s. | .. |
| d „ „ „ medium | „ | 2/6 to 4/- | .. |
| d „ „ „ large | „ | 4/6 to 8/6 | .. |
| p Phosphor Bronze, plain castings | „ | 1/- to 1/1½ | .. |
| p „ „ rolled bars & rods | „ | 1/1½ to 1/3 | .. |
| p „ „ rolled strip & sheet | „ | 1/2½ to 1/6 | .. |
| o Platinum | per oz. | 111/6 | variable. |
| e Silicium Bronze Wire | per lb. | 9d. | .. |
| r Steel Magnet, in bars | per ton | £55 | .. |
| g Tin, Block (English) | „ | £134 10 to £135 10 | dec. |
| n „ Wire, Nos. 1 to 16 | per lb. | 1/9 | .. |
| p White Anti-friction Metals:— | | | |
| "White Ant" brand | per ton | £35 to £60 | .. |
| k Zinc, Sh's (Vieille Montagne bnd.) | „ | £26 10 | .. |

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

**Prospectuses.**—*Val D'Or Rubber Estates, Ltd.*—This company has been offering 650,000 shares of 2s. each for subscription. The company is to acquire an estate of 2,860 acres in the Settlement of Penang, Straits Settlements.

*Sungei Buaya (Sumatra) Rubber Co., Ltd.*—This company, which has been offering for subscription at par 63,000 shares of £1 each, is acquiring the Bandar Kuala Estate, in the Serdang District. There are over 107,000 trees planted of ages ranging from one to four years.

The Sapumalkande Rubber Co., Ltd., and the Kimanis Rubber, Ltd., have also offered issues this week.

**Mexican Light and Power Co., Ltd.**—The directors have declared a dividend of 1 per cent. on the ordinary shares.

**Cuba Submarine Telegraph Co., Ltd.**—The directors recommend a dividend at the rate of 6 per cent. per annum on the ordinary shares for the half-year to June 30th.

**Aron Electricity Meter, Ltd.**—The directors have declared a dividend of 3 per cent. on the preference shares.

**Bank Rate.**—The Bank Rate was yesterday raised to 4 per cent.

## STOCKS AND SHARES.

Tuesday Afternoon.

Money conditions have swung into a position of predominance, and last week's rise in the Bank Rate, followed by an advance on Monday in the Berlin Bank Rate, caused a check to Stock Exchange business generally. It cannot, however, be said that the rise in either was at all unexpected. This is the season of the year when requirements in connection with the moving of the world's crops call for capital, and a stiffening of money rates in October is as annual an event as the harvest itself.

The dramatic success of the issue of the New York Telephone bonds sent the premium up to 3½ per cent. above the price at which the bonds were offered. When the allotments came out, there was a little selling by stags, and the quotation fell to 1½ premium, at which it remained but a short time, being doubled again in the course of the day. Telephone issues are steady, and United River Plates gained ½, the new shares rising in proportion.

Marconi shares declined another $\frac{1}{16}$ to 13s. 9d., in spite of the brave face officially put upon the £15,000 bargain with the Government, and the reply to certain critics who had been inquiring about the life of some of the patents, the building up of reserves, and so on.

Telegraph descriptions are somewhat featureless. Cuba shares gained ¼, and Western Telegraphs ¼. Anglo-American Telegraph Deferred further declined. No change has taken place in the Trust Companies' issues. The stock and bonds of the American Telephone and Telegraph Company are both a point lower, it being suggested that some of the proprietors sold these in order to take up the New York Telephone scrip.

Electricity supply shares are mostly dull with movements few and far between. Metropolitan Ordinary rose ⅛, giving a market humourist an excuse for the remark that East Marylebone requires a good deal of illumination on its political affairs just now. City of London and Charing Cross and Strand both weakened. London Electrics are ⅛ down. Brompton and Kensington are flat upon an incessant stream of small sales. Victoria Falls Power Preference continue to follow Chartered shares, and $\frac{1}{32}$ advance has brought the price up to 18s. 9d. middle.

Mexican Light and Power Common rose 3 and the Preference 2, on the accumulating testimony as to the importance of the company and the comparative non-importance of the accident to the dam, a mishap which, it is claimed, cannot recur because of the way in which the re-building is being done. The group is firm generally. No change is marked in Mexico Tramways, Rio or Sao Paulo Trams. Canadian General Preference improved to 120. British Columbia Electric Railway Preference has advanced. Calcutta Trams drooped, although the Debenture stock pursues its quiet rise. Anglo-Argentine Second Preference declined slightly. British Electric Traction Ordinary, Preference and First Debenture have recovered.

The Home Railway market bestirred its sluggish prices to revival on the improving Board of Trade Returns, but the movement lived no longer than usual, and the hardening of money-rates caused the weakening of Railway prices. Districts stand out as a bright exception, having risen to 16½ upon obviously inspired statements as to the financial progress which the company is making, and of which every Londoner will rejoice with every District stockholder to learn. With this rise in the price of the Ordinary it is a little singular that the 6 per cent. Debenture should not be realisable at the lower of the two prices quoted in the Stock Exchange Official List, where the stock goes out 143-145.

Metropolitan Consolidated is ¼ up, and the hope is expressed that, as traffics will so soon be running against normal "takes" of a year ago, the figures may justify a further improvement. The four months of Exhibition traffics are now practically over, and the failure of this season's gathering at Shepherd's Bush will be forgotten—except when the report appears—in the anticipation of better results accruing in 1910 from the Anglo-Japanese Exhibition at the White City. Underground Electric Railway 6 per cent. income bonds have again receded a point.

Manufacturing shares show some degree of irregularity. India-Rubbers—still called "Silvers," as the market colloquialism—rose 5s., and so did General Electric Preference. Dick, Kerr Preference are a shade easier. The full amount of the rise in armament shares was not retained. Rubber shares have moved wildly, hardening up after being distinctly flat. It is thought that some of the weaker holders of rubber shares have been shaken out on the fall, and that the market is in so much a healthier state for their disappearance.

**Calcutta Tramways Co., Ltd.**—The directors have declared an interim dividend of 2s. per share on the ordinary shares (being at the rate of 4 per cent. per annum, free of income-tax), on account of the profits for the half-year to June 30th.

# SHARE LIST OF ELECTRICAL COMPANIES.

## TELEGRAPH AND TELEPHONE COMPANIES.

| Present Issue. | NAME. | Stock or Share. * | Dividends for the last four years. 1905. | 1906. | 1907. | 1908. | Closing Quotations Oct. 5th. | Closing Quotations Oct. 12th. | Business done week ended Oct. 14th, 1909. Highest | Lowest. | Rise + or Fall — | Present Yield per cent. £ s. d. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25,000 | Amazon Telegraph Co.'s shares, Nos. 1 to 25,000 | 10 | Nil | Nil | Nil | Nil | 2⅞ — 3⅛ | 3 — 3⅛ | .. | .. | + ⅛ | Nil. |
| 126,700 | Do. do. 5 % Debs., Nos. 1 to 1,350 Red. | 100 | 5 % | 5 % | 5 % | 5 % | 93 — 96 | 94 — 97 | 94⅜ | .. | +1 | 5 3 1 |
| $131,551,400 | American Telephone & Telegraph, Cap. Stock .. | $100 | 7½ % | 8 % | 8 % | 8 % | 146 —148 | 145 —147 | 147⅛ | .. | —1 | 5 8 10 |
| $63,000,000 | Do. Collat. Trust, 4% Bonds, 1 to 25,000 and 53,001 to 78,000 | $1000 | 4 % | 4 % | 4 % | 4 % | 97 — 99 | 96 — 98 | .. | .. | —1 | 4 1 8 |
| 558,460 | Anglo-American Telegraph .. .. .. .. | Stock | 3½% | 3½% | 3½% | £3 4s. | 61¼ — 63¼ | 61½ — 63½ | .. | .. | .. | 5 2 3 |
| 3,220,770 | Do. do. do. 5 % Pref. .. .. | Stock | 6 % | 6 % | 6 % | 6 % | 104 —105 | 104 —105 | 104⅜ | 104 | .. | 5 14 3 |
| 3,220,770 | Do. do. do. Deferred .. .. | Stock | 1½% | 12½% | 1 %- | 8/- | 21¾ — 21⅞ | 20⅞ — 21⅛ | 21⅛ | 21 | — ⅞ | 1 17 10 |
| 47,725 | Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red. | 100 | 5 % | 5 % | 5 % | 5 % | 101 —103 | 101 —103 | .. | .. | .. | 4 17 1 |
| 44,000 | Chili Telephone, Nos. 1 to 44,000 .. .. .. | 5 | 8 | 8 | 8 | 8 % | 8 — 8⅜ | 8 — 9⅜ | .. | .. | .. | 4 14 1 |
| 2,431,350 | Commercial Cable, Sting. 500 year 4% Deb. Sk. Red. | Stock | 4 % | 4 % | 4 % | 4 % | 89 — 91 | 88 — 90 xd. | 89 | 88½ | .. | 4 8 11 |
| 16,000 | Cuba Telegraph .. .. .. .. .. | 10 | 5 % | 5 % | 6 % | 6 % | 8⅛ — 9⅛ | 8⅜ — 9⅜ | 8⅜ | .. | + ⅛ | 6 8 0 |
| 6,000 | Do. 10 % Pref. .. .. .. .. | 10 | 10 % | 10 % | 10 % | 10 % | 17⅛ — 18⅛ | 17⅜ — 1·⅛ | .. | .. | + ⅛ | 5 8 1 |
| 12,981 | Direct Spanish Telegraph, Ord. .. .. .. | 5 | 4 % | 4 % | 4 % | 4 % | 3 — 3⅛ | 3 — 3⅛ | .. | .. | .. | 5 14 8 |
| 6,000 | Do. do. 10 % Cum. Pref. .. | 10 | 10 % | 10 % | 10 % | 10 % | 8 — 8⅛ | 8 — 8⅛ | .. | .. | .. | 6 5 0 |
| 80,000 | Do. do. 4½ % Debs. .. .. | 20 | 4½% | 4½% | 4½% | 4½% | 100½ -102½ | 100½ -10·½ | .. | .. | .. | 4 3 11 |
| 60,710 | Direct United States Cable .. .. .. | 20 | 4½% | 4½% | 4½% | 4½% | 18½ — 19⅜ | 18½ — 18⅝ | 18½ | 18⅛ | .. | 7 4 8 |
| 43,500 | Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R. | 100 | 4½% | 4½% | 4½% | 4½% | 100 —102 | 100 —102 | .. | .. | .. | 4 8 3 |
| 4,000,000 | Eastern Telegraph, Ord. Stock.. .. .. .. | Stock | 7 % | 7 % | 7 % | 7 % | 129 —131 | 129 —132 | 130⅜ | 129½ | .. | 5 6 10 |
| 2,000,000 | Do. 3½ % Pref. Stock.. .. .. | 100 | 3½% | 3½% | 3½% | 3½% | 85 — 87 | 85 — 87 | 86½ | 85⅜ | .. | 4 0 6 |
| 1,996,706 | Do. 4 % Mort. Deb. Stock. Red. .. | Stock | 4 % | 4 % | 4 % | 4 % | 104 —106 | 104 —106 | 105⅜ | .. | .. | 3 15 6 |
| 300,000 | Eastern Extension, Australasia, and China Tele | 10 | 7 % | 7 % | 7 % | 7 % | 11⅞ — 12⅛ | 11⅞ — 12⅛ | 12⅛ | 11⅞ | .. | 5 14 3 |
| 752,400 | Do. 4 % Deb. Stock .. .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 102 —104 | 102 —104 | 102½ | .. | .. | 3 16 11 |
| 200,000 | East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000 | 25 | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | .. | .. | .. | 3 18 5 |
| 181,127 | Globe Telegraph and Trust .. .. .. | 10 | 5⅓% | 5⅓% | 5⅓% | 5⅓% | 10⅛ — 10⅜ | 10⅛ — 10⅜ | 10⅛ | 10⅜ | .. | 5 8 3 |
| 181,127 | Do. do. 6 % Pref... .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 13⅜ — 14⅛ | 13⅜ — 14⅛ | 13⅜ | 13⅛ | .. | 4 4 3 |
| 150,000 | Great Northern Telegraph, of Copenhagen.. .. | 10 | 24% | 20 % | 20 % | 18 % | 26 — 27 | 26 — 27 | .. | .. | .. | 6 13 4 |
| 10,000 | Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red. | 100 | 4½% | 4½% | 4½% | 4½% | 100 —102 | 100 —102 | .. | .. | .. | 4 8 3 |
| 17,000 | Indo-European Telegraph .. .. .. | 25 | 18 % | 18 % | 18 % | 18 % | 51½ — 53½ | 51½ — 53½ | 53½ | .. | .. | 6 1 6 |
| $41,380,400 | Mackay Companies Common .. .. .. | $100 | 2 % | 3½% | 4 % | 4 % | 94 — 97 | 94 — 96 | .. | .. | —1 | 4 3 4 |
| $50,000,000 | Do. do. 4% Cum. Pref. .. .. .. | $100 | 4 % | 4 % | 4 % | 4 % | 80 — 82 | 75 — 78 | .. | .. | —4½ | 5 3 7 |
| 394,190 | Marconi's Wireless Telegraph .. .. .. | 1 | Nil | Nil | Nil | Nil | ⅛ — ⅛ | ⅜ — ⅜ | 14/9 | 14/4½ | — 3/16 | N'l |
| 72,680 | Monte Video Telephone Co., Ltd. Ord. .. .. | 1 | 5 % | 5 % | 5 % | 5 % | ⅜ — ⅜ | ⅜ — ⅜ | .. | .. | .. | 6 17 2 |
| 86,492 | Do. do. do. 5 % Pref. .. | 1 | 5 % | 5 % | 5 % | 5 % | ⅜ — ⅜ | ⅜ — ⅜ | 16/8 | 16/- | .. | 5 14 3 |
| 2,225,000 | National Telephone, Pref. Stock .. .. .. | 100 | 6 % | 6 % | 6 % | 6 % | 106½ —108 | 106⅜ —108 | 107⅛ | 107 | .. | 5 11 7 |
| 3,725,000 | Do. do. Def. Stock .. .. .. | 100 | 5 % | 5 % | 6 % | 6 % | 121 —123 | 121 —123 | 122½ | 121½ | .. | 4 17 2 |
| 15,000 | Do. do. 6 % Cum. 1st. Pref. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 10½ — 11 | 10½ — 11 | .. | .. | .. | 5 9 1 |
| 15,000 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | 6 % | 5 % | 6 % | 6 % | 10⅛ — 10⅞ | 10⅜ — 10⅞ | .. | .. | .. | 5 10 4 |
| 250,000 | Do. do. 5 % Non-cum. 3rd P., 1 to 250,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5 1/16 — 5 1/8 | 5 1/16 — 5 1/8 | 5 1/8 | 5 1/16 | .. | 4 7 8 |
| 2,000,000 | Do. do. 3½ % Deb. Stock Red. .. | Stock | 3½% | 3½% | 3½% | 3½% | 98 —100 | 98 —100 | 98⅜ | .. | .. | 3 18 5 |
| 1,988,593 | Do. do. 4 % Deb. Stock Red. .. .. | 100 | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | .. | .. | .. | 5 5 9 |
| 179,813 | Oriental Telep. and Elec. 1 to 171,504, fully paid .. | 1 | 7 % | 7 % | 8 % | 8 % | 1 13/16 — 1 15/16 | 1 13/16 — 1 15/16 | .. | .. | .. | 4 14 9 |
| 50,000 | Do. do. 6 % Cum. Pref... .. | 1 | 6 % | 6 % | 6 % | 6 % | 1 1/16 — 1 1/8 | 1 1/16 — 1 1/8 | .. | .. | .. | 4 1.. 0 |
| 99,100 | Do. do. do. 4 % Red. Deb. Stock .. | 100 | 4 % | 4 % | 4 % | 4 % | 86 — 88 | 86 — 88 | 86½ | .. | .. | 4 18 5 |
| 99,400 | Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000 | 10 | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | .. | .. | .. | 4 17 7 |
| 11,839 | Reuter's .. .. .. .. .. .. | 8 | 5 % | 5 % | 5 % | 5 % | 7½ — 8½ | 7½ — 8½ | .. | .. | .. | 4 7 10 |
| 145,955 | Telephone Co. of Egypt, 4½ % Deb. Red. .. .. | 100 | 4½% | 4½% | 4½% | 4½% | 100½ —102½ | 100½ —102½ | .. | .. | .. | 4 9 7 |
| 3,042 | Submarine Cables Trust .. .. .. .. | Certs. | 6 % | 6 % | 6 % | 6 % | 181 —184 | 181 —184 | .. | .. | .. | 5 12 3 |
| 120,000 | United River Plate Telephone .. .. .. .. | 5 | 8 % | 8 % | 8 % | 8 % | 6½ — 7 | 6⅞ — 7⅛ | 7 1/16 | 7 | + ⅛ | 5 12 3 |
| 40,000 | Do. 5 % Cum. Pref., Nos. 1 to 40,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5½ — 5⅝ | 5⅞ — 5⅝ | .. | .. | .. | 4 8 10 |
| 80,008 | W. Coast of America, 1 to 80,000 & 58,001 to 58,008 | 2½ | Nil | 2½% | 2½% | 2½% | 1 1/16 — 1 1/8 | 1 1/16 — 1 1/8 | .. | .. | .. | 3 18 4 |
| 150,000 | Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | .. | .. | .. | 4 18 5 |
| 207,980 | Western Telegraph, Ltd., Nos. 1 to 207,980.. .. | 10 | 7 % | 7 % | 7 % | 7 % | 13⅜ — 13⅞ | 13⅜ — 14 | 13 1/8 | .. | + ⅛ | 5 0 0 |
| 800,000 | Do. do. 4 % Deb. Stock Red. .. | 100 | 4 % | 4 % | 4 % | 4 % | 103 —105 | 103 —105 | .. | .. | .. | 3 16 2 |
| 88,321 | West India and Panama Telegraph .. .. .. | 10 | Nil | Nil | Nil | Nil | 1/16 — 1/8 | 1/16 — 1/8 | 15/7½ | 15/6 | .. | Nil |
| 34,568 | Do. do. 6 % Cum. 1st Pref. .. .. | 10 | 5 % | 8 % | 6 % | 6 % | 8⅝ — 9⅛ | 8⅝ — 9⅛ | 8 5/32 | 8 1/16 | .. | 6 9 9 |
| 4,669 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | Nil | Nil | £2 6 | 15 % | 8⅛ — 9⅜ | 8⅛ — 9⅜ | .. | .. | .. | 15 15 10 |
| 80,000 | Do. do. 5 % Debs., Nos. 1 to 1,800 .. | 100 | 5 % | 5 % | 5 % | 5 % | 101½ —103½ | 101½ —103½ | .. | .. | .. | 4 16 7 |

## ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 640,000 | Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000 | 5 | .. | .. | .. | .. | 4⅜ — 4⅞ | 4⅜ — 4⅞ | 96/10½ | 93.9 | .. | 5 2 4 |
| 500,000 | Do. 5 % 2nd Pref., 800,001 to 1,300,000 | 5 | .. | .. | .. | .. | 4⅜ — 4⅝ | 4 7/16 — 4 5/16 | 90/- | .. | — 3/16 | 5 6 |
| 978,220 | Do. 4 % Deb. Stock .. .. .. | .. | .. | .. | .. | 4 % | 92½ —93½ | 92½ — 93½ | 93 | 92½ | .. | 4 5 10 |
| 382,387 | Auckland E. Trams, 5 % 1st Mort. Deb. Stock .. | 100 | 5 % | 5 % | 5 % | 5 % | 102 —105 | 102 —105 | 103½ | .. | .. | 4 15 3 |
| 380,000 | Babcock & Wilcox, 1 to 580,000 .. .. .. .. | 1 | 20 % | 20 % | 20 % | 20 % | 4⅜ — 4½ | 4⅜ — 4½ | 90/- | 88/9 | .. | 4 8 11 |
| 100,000 | Do. do. 6 % Cum. Pref., 1 to 100,000 .. | 1 | 6 % | 6 % | 6 % | 6 % | 1⅜ — 1⅝ | 1⅜ — 1⅝ | .. | .. | .. | 4 0 0 |
| 60,000 | British Aluminium, Ord., 1 to 40,000 .. .. .. | 5 | 7 % | 7 % | 7 % | 7 % | ⅞ — 1 | ⅞ — 1 | 17/6 | 17/3 | .. | 35 0 0 |
| 60,000 | Do. do. 7 % Cum. Pref. .. .. .. | 5 | 7 % | 7 % | 7 % | 7 % | 1⅞ — 2⅛ | 1⅞ — 2⅛ | .. | .. | .. | 15 1 4 |
| 40,100 | Do. do. "A" 6 % Cum. Pref. .. .. | 5 | 6 % | 6 % | 6 % | 6 % | 3⅜ — 3⅝ | 3⅜ — 3⅝ | .. | .. | .. | 7 10 11 |
| 12,897 | Do. do. 4 % Funding Certs. .. .. | 5 | 4 % | 4 % | 4 % | 4 % | 2⅜ — 3⅛ | 2⅜ — 3⅛ | .. | .. | .. | 5 14 3 |
| 124,400 | Do. do. 5½ % Loch Leven Debs, .. | 100 | .. | 5½% | 5½% | 5½% | 96 — 99 | 96 — 99 | .. | .. | .. | 5 14 7 |
| 500,000 | British Columbia E. Rail Def. Ord. Stock .. .. | 100 | 6 % | 6 % | 8 % | 8 % | 144 —149 | 144 —149 | 146 | .. | .. | 5 7 5 |
| 400,000 | Do. Pref. Ord. Stock .. .. .. .. | 100 | 5 % | 5 % | 5 % | 6 % | 120 —125 | 120 —125 | .. | .. | .. | 4 16 0 |
| 400,000 | Do. 5 % Cum. Perp. Pref. Stock .. .. | 100 | 5 % | 5 % | 5 % | 5 % | 106 —110 | 109 —112 | 111 | 109½ | +2½ | 4 9 3 |
| 233,000 | Do. 4½ % 1st Mort. Debs., 1 to 6,250 .. .. | 40 | 4½% | 4½% | 4½% | 4½% | 102 —104 | 102 —104 | 102½ | 102½ | .. | 4 6 7 |
| 212,600 | Do. 4½ % Vancouver Power Debs., 1 to 2,200 | 100 | 4½% | 4½% | 4½% | 4½% | 102 —105 | 102 —105 | .. | .. | .. | 4 5 9 |
| 488,801 | British Electric Traction .. .. .. .. | 10 | 3 % | Nil | Nil | Nil | ⅝ — ¾ | ⅝ — 1 | 16/3 | 11/10½ | + 3/16 | Nil |
| 161,487 | Do. do. 6 % Cum. Pref. .. .. | 10 | 6 % | 6 % | 3 % | 1¾% | 1⅜ — 2⅜ | 2 — 2½ | 47/6 | 43/9 | + ⅛ | 6 0 0 |
| 1,478,658 | Do. do. 5 % Perp. Deb. Stock .. | Stock | 5 % | 5 % | 5 % | 5 % | 81½ — 84½ xd | 82 — 85 | 83½ | 83 | + ⅛ | 5 17 8 |
| 628,986 | Do. do. 4½ % 2nd Deb. Stock Red. | 100 | 4½% | 4½% | 4½% | 4½% | 62 — 66 | 62 — 66 | .. | .. | .. | 6 16 4 |
| 100,000 | British Insulated and Helsby Cables .. .. | 5 | 8 % | 10 % | 10 % | 10 % | 7⅛ — 7⅝ | 7⅛ — 7⅝ | .. | .. | .. | 6 10 2 |
| 100,000 | Do. do. 6 % Cum. Pref. .. .. | 5 | 6 % | 6 % | 6 % | 6 % | 6⅜ — 6⅝ | 6⅜ — 6⅝ | .. | .. | .. | 4 11 3 |
| 500,000 | Do. do. 4½ % 1st Mort. Deb. Red. .. | 100 | 4½% | 4½% | 4½% | 4½% | 103 —106 | 103 —106 | .. | .. | .. | 4 4 11 |
| 204,940 | British Thomson-Houston 4½ % 1st Mort. Debs. .. | 100 | 4½% | 4½% | 4½% | 4½% | 89 — 94 | 89 — 94 | .. | .. | .. | 4 15 9 |
| 400,000 | British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000 | 5 | Nil | Nil | Nil | Nil | 3/16 — 7/16 | 3/16 — 7/16 | .. | .. | .. | Nil |
| 1,116,358 | Do. do. 4 % Mort. Deb. Stock .. | 100 | 4 % | 4 % | 4 % | 4 % | 38 — 42 | 39 — 42 | .. | .. | + ½ | 9 10 6 |
| 50,000 | Browett, Lindley & Co., Ord. .. .. .. | 1 | Nil | Nil | Nil | Nil | ⅝ — 1⅛ | ⅝ — 1⅛ | .. | .. | .. | Nil |
| 50,000 | Do. do. 6 % Cum. Pref. .. .. | 1 | Nil | Nil | Nil | Nil | 14/6 to 15/6 | 14/6 to 15/6 | .. | .. | .. | Nil |
| 140,976 | Brush Electrical Engineering, Ord., 1 to 105,731 .. | 3 | 2½% | Nil | Nil | Nil | 0 — ⅛ | 0 — ⅛ | .. | .. | .. | Nil |
| 200,000 | Do. do. Non-cum. 6 % Pref. .. .. | 3 | 6 % | Nil | Nil | Nil | 0 — ⅛ | 0 — ⅛ | .. | .. | .. | Nil |
| 135,000 | Do. do. 4½ % Perp. Deb. Stock .. | Stock | 4½% | 4½% | 4½% | 4½% | 41 — 46 | 41 — 46 | .. | .. | .. | 9 15 8 |
| 125,000 | Do. do. 4½ % Perp. 2nd Deb. Stock.. | Stock | 4½% | 4½% | 4½% | 4½% | 27 — 31 | 27 — 31 | .. | .. | .. | 14 10 2 |
| 137,610 | Calcutta Trams, 1 to 137,610 .. .. .. | 5 | 8 % | 8 % | 6 % | 4½% | 4⅛ — 5⅜ | 4⅜ — 5⅜ | .. | .. | — ⅛ | 4 5 9 |
| 45,804 | Do. 5 % Cum. Pref., Nos. 1 to 29,380.. | 5 | 5 % | 5 % | 5 % | 5 % | 4⅜ — 5 | 4⅜ — 5 | 97/6 | 96/8 | .. | 5 0 0 |
| 850,000 | Do. 4½ % 1st Deb. Stock.. .. .. | 100 | 4½% | 4½% | 4½% | 4½% | 99 —102 | 100 —103 | 1·2 | .. | +1 | 4 7 5 |
| 85,000 | Callender's Cable Construction shares .. .. | 5 | 15 % | 15 % | 15 % | 15 % | 10⅜ — 11⅛ | 10⅜ — 11⅛ | 10⅜ | .. | .. | 6 7 8 |
| 40,000 | Do. do. 5 % Cum. Pref. .. .. | 5 | 5 % | 5 % | 5 % | 5 % | 6⅜ — 6⅞ | 6⅜ — 6⅞ | .. | .. | .. | 4 6 11 |
| 800,000 | Do. do. 4½ % 1st Mort. Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | 4½% | 105 —107 | 105 —107 | .. | .. | .. | 4 4 1 |
| 491,222 | Cape E. Trams., 1 to 491,222 .. .. .. | 1 | Nil | Nil | Nil | Nil | 1/16 — 1/8 | 1/16 — 1/8 | .. | .. | .. | Nil |
| 450,000 | Castner-Kellner Alkali, 1 to 450,000 .. .. .. | 1 | 6 % | 8 % | 12 % | 12½% | 2 — 2⅛ | 2 — 2⅛ | 41/9 | 41/6 | .. | 5 17 8 |
| 210,158 | Do. do. 4½ % 1st Mort. Deb. Stock | 100 | 4½% | 4½% | 4½% | 4 % | 106 —109 | 106 —109 | .. | .. | .. | 3 13 5 |
| 1,890,690 | Central London Railway, Ord. Stock.. .. .. | Stock | 4 % | 4 % | 3 % | 3½% | 61 — 63 | 61 — 63 | 62½ | .. | .. | 5 3 2 |
| 554,655 | Do. do. 4 % Pref. Stock .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 85 — 87 | 85 — 87 | 86½ | 86½ | .. | 4 14 2 |
| 554,655 | Do. do. Def. do. .. .. | Stock | 4 % | 4 % | 2 % | 2½% | 43 — 45 | 43 — 45 | 44⅛ | 44 | .. | 5 11 1 |
| 1,000,000 | City and South London Railway .. .. .. | Stock | 1½% | 2½% | 3½% | 1½% | 80½ - 81½ | 80½ - 81½ | 81 | .. | .. | 4 15 3 |
| 85,000 | Crompton & Co., Nos. 1 to 85,000 .. .. .. | 5 | 2½% | 5 % | 5 % | 5 % | ⅜ — ½ | ⅜ — ½ | .. | .. | .. | 13 6 8 |
| 100,000 | Do. 5 % 1st Mort. Reg. Debs., 1 to 999 of £100, and 991 to 1,000 of £50 Red. | .. | 5 % | 5 % | 5 % | 5 % | 90 — 93 | 90 — 93 | .. | .. | .. | 5 7 6 |

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

## SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

### ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

| Present Issue. | NAME. | Stock or Share. | Dividends for the last four years. 1905. | 1906. | 1907. | 1908. | Closing Quotations Oct. 5th. | Closing Quotations Oct. 12th. | Business done week ended Oct. 12th, 1909. Highest | Lowest | Rise + or Fall — | Present Yield per cent. £ s. d. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 260,000 | Dick, Kerr & Co., 1 to 260,000 | 1 | 10 % | 10 % | 10 % | 10 % | 1 — 1⅛ | 1 — 1⅛ | 21/3 | .. | .. | 8 17 9 |
| 305,000 | Do. do. 6 % Cum. Pref., 1 to 305,000 | 1 | 6 % | 6 % | 6 % | 6 % | 1 1/16 — 1 1/8 xd | 1 — 1⅛ | .. | .. | — 1/16 | 5 6 8 |
| 271,080 | Do. do. 4½ % Deb. Stock | 100 | 4½ % | 4½ % | 4½ % | 4½ % | 100 —103 | 100 —103 | .. | .. | .. | 4 7 5 |
| 60,000 | Dublin United Trams. (1896), 6 % Pref., 1 to 60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 12⅜ — 13⅜ | 12⅜ — 13⅜ | .. | .. | .. | 4 7 8 |
| 99,261 | Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261 | 5 | 4½ % | 4½ % | 2½ % | 1½ % | 1/16 — 1/8 | 1/16 — 1/8 | 10/- | 5/- | .. | 21 0 0 |
| 17,189 | Do. "A" shares, 01—017,189 | 5 | 4½ % | 4½ % | 2½ % | 2½ % | 1 — 1⅛ | 1 — 1⅛ | .. | .. | .. | 8 6 8 |
| 307,895 | Do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 68 — 73 | 68 — 73 | .. | .. | .. | 5 9 7 |
| 57,720 | Do. 5 % 2nd Deb. Stock Prov. Certs. all pd. | 100 | 5 % | 5 % | 5 % | 5 % | 82 — 85 xd | 82 — 85 | .. | .. | .. | 5 12 4 |
| 112,100 | Electric Construction, 1 to 112,100 | 2 | Nil | Nil | Nil | Nil | 1/16 — 1/8 | 1/16 — 1/8 | .. | .. | .. | Nil |
| 31,890 | Do. do. 7 % Cum. Pref., 1 to 31,890 | 2 | 7 % | 7 % | 7 % | 7 % | 1 1/16 — 1 1/8 | 1 1/16 — 1 1/8 | .. | .. | .. | 9 13 1 |
| 25,000 | General Electric Co. (1900), 5 % Cum. Pref. | 10 | 5 % | 5 % | 5 % | 5 % | 8 — 8¼ | 8¼ — 8⅜ | .. | .. | + ⅛ | 5 14 3 |
| 200,000 | Do. do 4 % Mort Deb. | Stock | 4 % | 4 % | 4 % | 4 % | 83 — 87 xd | 83 — 87 | .. | .. | .. | 4 12 0 |
| 78,000 | Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000 | 10 | 4 % | 4 % | ¼ % | Nil | 1/16 — 1/8 | 1/16 — 1/8 | .. | .. | .. | 6 19 4 |
| 96,000 | Greenwood & Batley, 7 % Cum. Pref. | 10 | 7 % | 7 % | 7 % | .. | 10½ — 10⅝ | 10½ — 10⅝ | .. | .. | .. | 6 10 8 |
| 80,000 | Do. do. 5 % Mort. Debs. | 100 | 5 % | 5 % | 5 % | 5 % | 102 —103½ | 102 —103 | .. | .. | .. | 4 16 10 |
| 40,000 | Henley's (W. T.), Telegraph Works, Ord. | 5 | 15% | 15 % | 15% | 15 % | 12⅞ — 13⅛ | 12⅞ — 13⅛ | .. | .. | .. | 5 12 2 |
| 40,000 | Do. do. 4½ % Pref. | 5 | 4½ % | 4½ % | 4½ % | 4½ % | 5⅛ — 5⅜ | 5⅛ — 5⅜ | .. | .. | .. | 4 1 10 |
| 150,000 | Do. do. 4½ % Mort. Deb. Stock | Stock | 4½ % | 4½ % | 4½ % | 4½ % | 106 —108 | 106 —108 | .. | .. | .. | 4 3 4 |
| 50,000 | India-Rubber, Gutta-percha & Telegraph Works. | 10 | 10 % | 10 % | 10 % | 10 % | 14⅜ — 15½ | 15 — 15⅝ | 15⅛ | 15⅛ | + ⅛ | 6 14 3 |
| 37,500 | †Liverpool Overhead Railway, Ord. | 10 | Nil | Nil | ¼ % | Nil | ⅜ — ½ | ⅜ — ½ | .. | .. | .. | Nil |
| 10,000 | † Do. do. Pref., fully paid | 10 | 5 % | 5 % | 5 % | 5 % | 4¾ — 5 | 4¾ — 5 | .. | .. | .. | 10 0 0 |
| 600,070 | London United Trams. (1901), 1 to 50,007 | 10 | 3 % | 3 % | 3 % | Nil | 1⅛ — 2⅛ | 1⅛ — 2⅛ | .. | .. | .. | Nil |
| 599,280 | Do. do. 60,008 to 100,000 | 10 | 3 % | 3 % | 3 % | Nil | 1⅛ — 2⅛ | 1⅛ — 2⅛ | .. | .. | .. | Nil |
| 125,000 | Do. do. 5 % Cum. Pref., 1 to 125,000 | 10 | 5 % | 5 % | 5 % | 3⅔% | 2⅛ — 2⅜ | 2⅛ — 2⅜ | 48/9 | .. | .. | 18 12 8 |
| 1,881,000 | Do. do. 4 % 1st Mort. Deb. Stock | 100 | 4 % | 4 % | .. | 4 % | 67 — 70 | 67 — 70 | .. | .. | .. | 5 14 4 |
| 5,782,062 | Metropolitan Consolidated | 100 | 2⅜% | 1 % | ⅛% | ⅛% | 38 — 38⅛ | 38⅛ — 38⅜ | 39⅛ | 38 | .. | 1 6 0 |
| 2,640,914 | Do. Surplus Lands | 100 | 2⅜% | 2⅜% | 2⅜% | 2⅜% | 65 — 67 | 65 — 67 | 65⅝ | 65 | .. | 4 2 1 |
| 3,285,000 | Do. District | 100 | Nil | Nil | Nil | Nil | 15⅞ — 16⅛ | 16⅛ — 16⅜ | 16⅛ | 15⅞ | + ⅛ | Nil |
| 891,387 | Metropolitan Electric Trams., Ord. | 1 | .. | .. | .. | 44% | ⅛ — ⅜ | ⅛ — ⅜ | .. | .. | .. | .. |
| 314,016 | Do. do. Defd. | 1 | Nil | Nil | Nil | Nil | ⅛ — ⅜ | ⅛ — ⅜ | .. | .. | .. | Nil |
| 500,000 | Do. do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | ⅛ — ⅜ | ⅛ — ⅜ | 15/- | .. | .. | 6 3 1 |
| 595,600 | Do. do. 4½ % Deb. Stock Red. | 100 | 4½ % | 4½ % | 4½ % | 4½ % | 94½ — 96½ | 94½ — 96½ | 95½ | 92½ | .. | 4 13 3 |
| 10,823,200 | Mexico Trams Co., Common Stock | .. | .. | .. | .. | .. | 127 —130 | 127 —130 | 129 | 127½ | .. | .. |
| $9,000,000 | Do. 1st Mort. 50-year 5% Gld. Bds. | .. | .. | .. | .. | 5 % | 92 — 94 | 92 — 94 | 99½ | 92½ | .. | 5 6 5 |
| 245,500 | Potteries Electric Traction | 1 | 4 % | 4 % | 4 % | Nil | ⅛ — ⅜ | ⅛ — ⅜ | .. | .. | .. | .. |
| 245,500 | Do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | ⅛ — ⅜ | ⅛ — ⅜ | .. | .. | .. | 6 17 11 |
| 245,000 | Do. 4½ % Deb. Stock | 100 | 4½ % | 4½ % | 4½ % | 4½ % | 86 — 89 | 86 — 89 | .. | .. | .. | 5 1 2 |
| 87,350 | Telegraph Construction and Maintenance | 12 | 15 % | 15 % | 17½ % | 15 % | 34½ — 36 | 34½ — 36 | 35½ | 35 | .. | 5 0 0 |
| 140,000 | Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909 | 100 | 4 % | 4 % | 4 % | 4 % | 101 —103 | 101 —103 | .. | .. | .. | 3 17 8 |
| 1,000,000 | Underground Electric Railway, 5% Prior Lien | .. | .. | .. | .. | 5 % | 102½ —103½ | 102½ —103½ | 103½ | .. | .. | 4 16 7 |
| 2,800,000 | Do. do. 4½% Bonds | .. | .. | .. | .. | 4½% | 87 — 89 | 87 — 89 | 88 | 87⅜ | .. | 5 1 2 |
| 4,900,000 | Do. do. 6% Income Bonds | .. | .. | .. | .. | .. | 34 — 36 | 33 — 35 | 33 | .. | —1 | .. |
| 66,666 | Willans & Robinson, 1 to 80,000 & 80,001 to 116,666 | 5 | Nil | Nil | 10 % | Nil | ⅜ — ½ | ⅜ — ½ | .. | .. | .. | .. |
| 66,666 | Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666 | 1 | Nil | .. | 6 % | 6 % | 2⅛ — 2⅜ | 2⅛ — 2⅜ | 45/- | .. | .. | 2 8 0 |
| 245,495 | Do. % 1st Mort. Deb. Stock | | 4 % | 4 % | 4 % | 4 % | 76 — 80 xd | 76 — 80 | 77 | 76½ | .. | 5 0 0 |

### ELECTRICITY SUPPLY COMPANIES.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15,000 | Bromley (Kent) E.L. & P., 1 to 15,000 | | 5½% | 5½% | 5½% | 5½% | 4⅛ — 4⅜ | 4⅛ — 4⅜ | .. | .. | .. | 5 2 1 |
| 70,000 | Do. do. 4½ % 1st. deb. stock | 100 | 4½% | 4½% | 4½% | 4½% | 98 — 96 | 98 — 9b | .. | .. | .. | 4 13 9 |
| 80,449 | Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000 | 5 | 10 % | 10% | 10 % | 10 % | 7⅛ — 7⅜ | 6½ — 7⅛ | 7⅛ | 7 1/16 | — ⅛ | 6 13 4 |
| 9,554 | Do. do. 7 % Cum. Pref. | 5 | 7 % | 7 % | 7 % | 7 % | 7⅛ — 8 | 6½ — 7⅛ | 7⅛ | 7 | — ⅛ | 4 13 4 |
| 886,876 | Central Electric Supply 4 % Guar. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 97 —100 | 97 —100 | .. | .. | .. | 4 18 5 |
| 80,000 | Charing Cross and Strand Electricity Supply | 5 | 5 % | 5 % | 5 % | 5 % | 4 — 4½ | 4 — 4½ | .. | .. | .. | 5 11 1 |
| 80,000 | Do. do. do. 4½ % Cum. Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 4⅜ — 5 | 4⅜ — 4¾ | .. | .. | — 1/16 | 4 12 4 |
| 80,000 | Do. "City Undertaking" 4½ % Cum. Prf. | 5 | 4½% | 4½% | 4½% | 4½% | 8¾ — 4⅜ | 8⅞ — 4¼ | .. | .. | — ⅛ | 5 5 11 |
| 445,736 | Do. do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 96 — 99 | 98 — 101 | 100½ | 99⅛ | +2 | 3 19 3 |
| 49,486 | Chelsea Electricity Supply, Ord. | 5 | 6 % | 4½% | 4½% | 4½% | 3¾ — 4 | 3¾ — 4 | 71/3 | .. | .. | 5 12 6 |
| 175,000 | Do. do. 4½ % Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | 4½% | 100 —103 | 100 —103 | .. | .. | .. | 4 7 5 |
| 70,595 | City of London Elec. Lighting, Ord. 40,001—110,595 | 10 | 6 % | 6 % | 6 % | 6 % | 10½ — 11 | 10⅜ — 10⅞ | 10⅜ | .. | — ⅛ | 5 10 4 |
| 40,000 | Do. 6 % Cum. Pref., 1 to 40,000 | 10 | 6 % | 6 % | 6 % | 6 % | 11⅜ — 12⅜ | 11⅜ — 12⅜ | .. | .. | .. | 4 12 4 |
| 400,000 | Do. 5% Db. Stk., Scrip. (iss. at 115) all pd. | .. | 5 % | 5 % | 5 % | 5 % | 121 —124 | 121 —124 | .. | .. | .. | 4 0 8 |
| 300,000 | Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd. | 100 | 4½% | 4½% | 4½% | 4½% | 100 —103 | 100 —103 | .. | .. | .. | 4 7 5 |
| 50,000 | County of Durham Electrical Power, Ord. | 5 | 4 % | 4 % | 2 % | .. | 1⅜ — 2 | 1⅜ — 2 | .. | .. | .. | 5 0 0 |
| 50,000 | Do. do. 5 % Pref. | 5 | 5 % | 5 % | 5 % | 5 % | 2¼ — 3⅜ | 2¼ — 3⅜ | .. | .. | .. | 7 8 2 |
| 250,000 | Do. do. 5 % 1st Mtg. Deb. | Stock | .. | .. | .. | 5 % | 93⅛ — 95⅛ | 93⅛ — 95⅛ | .. | .. | .. | 5 4 9 |
| 40,000 | County of London Electric Lighting, Ord. 1—40,000 | 10 | 5 % | 5 % | 5 % | 5 % | 7⅝ — 8⅛ | 7⅝ — 8⅛ | .. | .. | .. | 6 1 3 |
| 55,000 | Do. do. 6 % Pref., 40,001—60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 10⅝ — 11⅛ | 10⅝ — 11⅛ | 10⅛ | 10⅛ | .. | 5 7 10 |
| 400,000 | Do. do. 4½ % Deb. Stock | .. | 4½% | 4½% | 4½% | 4½% | 104 —107 | 104 —107 | .. | .. | .. | 4 4 1 |
| 400,000 | Do. do. 4½ % 2nd. Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 100 —103 | 100 —103 | .. | .. | .. | 4 7 5 |
| 80,000 | Edmundson's Electric Corporation, Ord. Shares | 5 | 4 % | Nil | Nil | Nil | ⅛ — ⅜ | ⅛ — ⅜ | .. | .. | .. | Nil |
| 80,000 | Do. do. 6 % Cum. Pref. | 5 | 6 % | 3 % | Nil | Nil | ⅛ — ⅜ | ⅛ — ⅜ | 13/9 | .. | .. | Nil |
| 420,500 | Do. do. 4½ % 1st Mort. Deb. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 57 — 60 | 57 — 60 | .. | .. | .. | 7 10 0 |
| $8,150,000 | Electrical Dev.Co.of Ontario, 6% 1stMtg.Gold Bnds. | $500 | .. | .. | .. | 5½% | 91 — 94 | 91 — 94 | .. | .. | .. | 6 5 5 |
| 10,000 | Folkestone, 1 to 10,000 | £ | 5½% | 5½% | 5½% | 5½% | 4⅜ — 4⅞ | 4⅜ — 4⅞ | .. | .. | .. | 6 12 10 |
| 10,000 | Do. 5 % Cum. Pref., 1 to 10,000 | £ | 5 % | 5 % | 5 % | 5 % | 4⅞ — 5⅛ | 4⅞ — 5⅛ | .. | .. | .. | 4 13 9 |
| 90,000 | Do. 4½ % 1st Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 97 —100 | 97 —100 | .. | .. | .. | 4 10 0 |
| 15,000 | Hove, 1 to 15,000 | 5 | 9 % | 9 % | 8¾% | 8¾% | 7⅞ — 7⅞ | 7⅞ — 7⅞ | .. | .. | .. | 5 11 6 |
| $1,376,000 | Kaministiquia Power Co., 5 % Gold Bnds. | .. | .. | .. | .. | 5 % | 99 —101 | 98 —101 | 100⅜ | 100½ | .. | 4 19 0 |
| 21,000 | Kensington and Knightsbridge Electric Ord. | 5 | 10 % | 10 % | 10 % | 8 % | 7 — 7⅛ | 7 — 7⅛ | .. | .. | .. | 5 4 1 |
| 90,000 | Do. do. do. 4 % Deben. Stk. | Stock | 4 % | 4 % | 4 % | 4 % | 95 — 98 | 95 — 98 | .. | .. | .. | 4 4 3 |
| 111,000 | London Electric Supply Corporation, Limited, Ord. | 3 | 4 % | 4 % | 2½% | 3 % | 1⅞ — 2⅛ | 1⅞ — 2⅛ | .. | .. | — ⅛ | 4 16 0 |
| 70,000 | Do. do. do. 6 % Pref. | 5 | 6 % | 6 % | 6 % | 6 % | 5 — 5⅛ | 5 — 5⅛ | .. | .. | .. | 5 17 1 |
| 882,255 | Do. do. 4 % 1st Mort. Deb. Stk. Red. | Stock | 4 % | 4½% | 4½% | 4 % | 93 — 97 | 93 — 97 | .. | .. | .. | 4 2 6 |
| 200,000 | Metropolitan Electric Supply, 1 to 100,000 | 5 | 10 % | 8 % | 6¾% | 5 % | 4 — 4⅛ | 4⅛ — 4⅜ | 88/9 | 86/- | — ⅛ | 5 8 1 |
| 98,121 | Do. 4½ % Cum. Pref. 1—71,106 | 9 | 4½% | 4½% | 4½% | 4½% | 4⅝ — 5 | 4⅝ — 5 | .. | .. | .. | 4 10 0 |
| 285,000 | Do. 4½ % 1st Mort. Deben. Stock | .. | 4½% | 4½% | 4½% | 4½% | 105 —108 | 105 —108 | 106 | .. | .. | 4 3 4 |
| 248,000 | Do. 3½ % Mort. Deben. Stock Redem. | Stock | 3½% | 3½% | 3½% | 3½% | 83½ — 86½ | 83½ — 86½ | .. | .. | .. | 4 0 11 |
| $6,000,000 | Mexican Electric Light Co.. 5% 1st Mtg. Gold Bnds | .. | 5 % | 5 % | 5 % | 5 % | 81 — 88 | 82 — 84 | 83 | 82½ | +1 | 5 19 1 |
| 13,585,000 | Do. Light and Power Co., Ltd., Common | $100 | .. | .. | .. | 3½% | 70 — 74 | 73 — 77 | 76 | 71 | +3 | 4 10 11 |
| $2,400,000 | Do. do. 7% Cum. Pref. Stk. | Stock | .. | .. | .. | 7 % | 102 —106 | 104 —108 | 106 | 104½ | +2 | 6 9 8 |
| $12,000,000 | Do. do. 5% 1st Mtg. Gold Bnds. | .. | .. | .. | .. | 5 % | 86 — 88 | 86 — 88 | 87 | 86 | .. | 5 13 8 |
| 950,000 | Midland Electric Corporation, 4½ % 1st Mort. Deb. | 100 | 4½% | 4½% | 4½% | 4½% | 97 — 100 | 98 — 100 | .. | .. | +1 | 4 10 0 |
| 180,491 | Newcastle-on-Tyne, 1 to 187,500 | 5 | 8 % | 8 % | 8 % | 2½% | 4⅜ — 4⅝ | 4⅜ — 4⅝ | .. | .. | .. | 2 14 0 |
| 187,500 | Do. 5 % Pref., 1 to 187,500 | 5 | 5 % | 5 % | 5 % | 5 % | 4⅛ — 5⅛ | 4⅛ — 5⅛ | .. | .. | .. | 4 16 8 |
| 196,500 | North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,965 | 100 | .. | .. | .. | .. | 100— 102 | 100 —102 | .. | .. | +1 | .. |
| 10,852 | Notting Hill Electric Lighting | 10 | 7½% | 7½% | 7½% | 7 % | 12⅛ — 13⅛ | 12⅛ — 13⅛ | .. | .. | .. | 5 6 8 |
| 20,000 | Oxford, 1 to 96 and 407 to 20,310 | 5 | 7 % | 7 % | 7 % | .. | 6 — 6⅛ | 6 — 6⅛ | .. | .. | .. | 5 7 8 |
| 80,000 | Do. 4 % Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 95 — 98 | 95 — 98 | .. | .. | .. | 4 1 8 |
| 119,694 | River Plate Elcty. Co. Ord. Nos. 1 to 120,507 | 1 | .. | 2½% | 6 % | 8 % | 1⅛ — 1⅛ | 1⅛ — 1⅛ | 31/- | 30/9 | .. | 5 7 1 |
| 100,000 | Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000 | 1 | 6 % | 6 % | 6 % | 6 % | 1 — 1⅛ | 1 1/16 — 1 1/8 | 21/9 | .. | + 1/16 | 5 1 1 |
| 200,000 | Do. do. 5% Deb. Stk. Red. | 100 | 5 % | 5 % | 5 % | 5 % | 103 —106 | 103 —106 | .. | .. | .. | 4 14 4 |
| 40,000 | St. James' and Pall Mall Electric Light, Ord. | 5 | 12½% | 10 % | 10 % | 10 % | 8⅝ — 9⅛ | 8¾ — 9 | 8⅞ | 8 1/16 | — ⅛ | 6 7 0 |
| 90,000 | Do. do. 7 % Pref. 20,081 to 40,080 | 5 | 7 % | 7 % | 7 % | 7 % | 7 — 7⅛ | 7 — 7⅛ | .. | .. | .. | 5 11 1 |
| 150,000 | Do. do. 3½ % Deb. Stock Red. | 100 | 3 % | 3½% | 3½% | 3½% | 84 — 88 | 84 — 88 | .. | .. | .. | 3 19 7 |
| 12,000 | Smithfield Markets Electric Supply, Ord. | 5 | 4 % | Nil | Nil | Nil | ⅛ — ⅜ | ⅛ — ⅜ | .. | .. | .. | Nil |
| 35,000 | South London Electric Supply, Ord. | 4 | 4 % | 3 % | 4 % | 5 % | 2⅝ — 3 | 2⅝ — 3 | .. | .. | .. | 6 13 4 |
| 120,000 | South Met. Elec. Lt. & Power, Ord. | 1 | 2½% | 2½% | 2½% | 2½% | 1/16 — 1/8 | 1/16 — 1/8 | .. | .. | .. | 4 8 11 |
| 142,968 | Do. do. 7 % Pref. | 1 | 7 % | 7 % | 7 % | 7 % | 1 1/16 — 1 1/8 | 1 1/16 — 1 1/8 | 22/6 | .. | .. | 5 17 11 |
| 224,530 | Do. do. 4½ % 1st Deb. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 100 —108 xd | 102 —105 | .. | .. | .. | 4 7 6 |
| 80,000 | Urban Electric Supply, Ord. | 5 | 5 % | 5 % | 5 % | 5 % | ⅜ — ½ xd | ⅜ — ½ | .. | .. | .. | 25 6 8 |
| 80,000 | Do. do. 5 % Cum. Pref. | 5 | 5 % | 5 % | 5 % | 5 % | 1½ — 1⅝ xd | 1½ — 1⅝ | .. | .. | .. | 14 5 4 |
| 275,000 | Do. do. 4½ % 1st Mort. Db. Stk. Red. | 100 | 4½% | 4½% | 4½% | 4½% | 74½ — 78½ xd | 74½ — 78½ | .. | .. | .. | 5 14 8 |
| 800,000 | Victoria Falls Power Co., Pref. Nos. 1 to 800,000 | 1 | .. | .. | .. | 5 % | ⅜ — ½ | ⅛ — 1 | 19/3 | .. | + 1/16 | 5 0 0 |
| 110,000 | Westminster Electric Supply, Ord. | 5 | 12 % | 12 % | 10 % | 10 % | 8¾ — 9 | 8¾ — 9 | 8⅞ | .. | .. | 5 11 1 |
| 81,279 | Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905) | 5 | 5 % | 4½% | 4½% | 4½% | 5 — 5⅛ | 5 — 5⅛ | 5⅛ | .. | .. | 4 3 0 |

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 3 per cent., October 7th, 1909.

## GERMANY'S EXPORTS OF ELECTRICAL GOODS DURING THE FIRST HALF OF 1909.

The following statement showing the quantity of electrical goods of various kinds exported from Germany during the six months ended June 30th, 1909, is taken from the recently issued official statistics; the figures for the corresponding period of 1908 have been given for purposes of comparison, increases and decreases being shown:—

| | In double centners (220·4 lb.). | | Increase or decrease. |
|---|---|---|---|
| | 1908. | 1909. | |
| *Dynamos, Motors, Converters, Transformers and Choking Coils, up to 5 Double Centners weight.—* | | | |
| To Austria-Hungary ... | 3,600 | 3,500 | — 100 |
| „ Great Britain ... | 2,000 | 1,200 | — 800 |
| „ Belgium ... ... | 1,500 | 1,700 | + 200 |
| „ Italy ... ... | 6,600 | 4,700 | — 1,900 |
| „ Netherlands ... ... | 1,300 | 1,200 | — 100 |
| „ Russia in Europe ... | 1,100 | 1,600 | + 500 |
| „ Spain ... ... | 1,300 | 1,000 | — 300 |
| „ Other countries ... | 9,400 | 8,200 | — 1,200 |
| Total ... | 26,800 | 23,100 | — 3,700 |
| *Ditto, over 5 Double Centners in weight.—* | | | |
| To France ... ... | 5,900 | 7,400 | + 1,500 |
| „ Switzerland ... ... | 1,500 | 800 | — 700 |
| „ Netherlands ... ... | 3,600 | 3,700 | + 100 |
| „ Belgium ... ... | 10,400 | 5,600 | — 4,800 |
| „ Great Britain ... | 12,000 | 5,100 | — 6,900 |
| „ Austria-Hungary ... | 5,100 | 4,400 | — 700 |
| „ Italy ... ... ... | 20,500 | 14,000 | — 6,500 |
| „ Russia in Europe ... | 3,600 | 5,400 | + 1,800 |
| „ Norway ... ... | 2,500 | 1,700 | — 800 |
| „ Spain ... ... ... | 7,200 | 7,900 | + 700 |
| „ Argentina ... ... | 6,300 | 3,200 | — 3,100 |
| „ Japan... ... ... | 4,000 | 6,100 | + 2,100 |
| „ British S. Africa ... | 3,800 | 4,200 | + 400 |
| „ Mexico ... ... | 3,600 | 1,200 | — 2,400 |
| „ Other countries ... | 18,000 | 11,300 | — 6,700 |
| Total ... | 108,000 | 82,000 | — 26,000 |
| *Rotors and Commutators.—* | | | |
| To Great Britain ... | 2,000 | 1,600 | — 400 |
| „ Austria-Hungary ... | 1,300 | 1,100 | — 200 |
| „ Italy ... ... ... | 2,100 | 1,400 | — 700 |
| „ Russia in Europe ... | 1,600 | 1,400 | — 200 |
| „ Other countries ... | 5,000 | 5,500 | + 500 |
| Total ... | 12,000 | 11,000 | — 1,000 |
| *Accumulators and Plates, without horn or rubber, &c.—* | | | |
| To Denmark ... ... | 2,100 | 3,900 | + 1,800 |
| „ Netherlands ... ... | 900 | 2,500 | + 1,600 |
| „ Sweden ... ... | 6,900 | 4,100 | — 2,800 |
| „ Argentine ... ... | 2,200 | 1,900 | — 300 |
| „ Other countries ... | 4,900 | 5,000 | + 100 |
| Total ... | 17,000 | 17,400 | + 400 |
| *Cables.—* | | | |
| To Netherlands ... ... | 12,500 | 13,600 | + 1,100 |
| „ Belgium ... ... | 19,800 | 17,600 | — 2,200 |
| „ Great Britain ... | 16,300 | 6,700 | — 9,600 |
| „ Denmark ... ... | 10,300 | 9,100 | — 1,200 |
| „ Sweden ... ... | 17,900 | 16,400 | — 1,500 |
| „ Spain ... ... ... | 4,200 | 3,600 | — 600 |
| „ Argentina ... ... | 12,700 | 17,800 | + 5,100 |
| „ Japan... ... ... | 4,800 | 2,300 | — 2,500 |
| „ Uruguay ... ... | 3,200 | 700 | — 2,500 |
| „ Italy ... ... ... | 3,900 | 5,800 | + 1,900 |
| „ Norway ... ... | 5,300 | 3,100 | — 2,200 |
| „ Brazil ... ... | 1,700 | 2,000 | + 300 |
| „ Other countries ... | 49,200 | 71,000 | + 21,800 |
| Total ... | 161,800 | 169,700 | + 7,900 |
| *Arc Lamps.—* | | | |
| To Belgium ... ... | 240 | 200 | — 40 |
| „ Russia in Europe ... | 290 | 300 | + 10 |
| „ Great Britain ... | 380 | 350 | — 30 |
| „ Argentina ... ... | 300 | 260 | — 40 |
| „ United States ... | 220 | 390 | + 170 |
| „ Other countries ... | 1,570 | 1,740 | + 170 |
| Total ... | 3,000 | 3,240 | + 240 |
| *Incandescent Lamps.—* | | | |
| To Austria-Hungary ... | 250 | 340 | + 90 |
| „ Italy ... ... ... | 400 | 340 | — 60 |
| „ Great Britain ... | 1,400 | 1,470 | + 70 |
| „ France ... ... | 300 | 520 | + 220 |
| „ Russia in Europe ... | 360 | 640 | + 280 |
| „ Other countries ... | 1,890 | 2,250 | + 360 |
| Total ... | 4,600 | 5,560 | + 960 |
| *Telegraph and Telephone Material.—* | | | |
| To France ... ... | 370 | 830 | + 460 |
| „ Great Britain ... | 1,300 | 1,100 | — 200 |
| „ Italy ... ... ... | 740 | 600 | — 140 |
| „ Austria-Hungary ... | 300 | 600 | + 300 |
| „ Switzerland ... ... | 390 | 410 | + 20 |
| „ Belgium ... ... | 680 | 1,400 | + 720 |
| „ Netherlands ... ... | 420 | 370 | — 50 |
| „ Russia in Europe ... | 640 | 610 | — 30 |
| „ Denmark ... ... | 370 | 350 | — 20 |
| „ Other countries ... | 1,990 | 1,930 | — 60 |
| Total ... | 7,200 | 8,200 | + 1,000 |
| *Electrical Apparatus for Lighting, Power, &c.—* | | | |
| To Belgium ... ... | 2,700 | 2,500 | — 200 |
| „ Great Britain ... | 3,400 | 2,300 | — 1,100 |
| „ Netherlands ... ... | 1,550 | 1,800 | + 250 |
| „ Spain ... ... ... | 1,700 | 2,800 | + 1,100 |
| „ Switzerland ... ... | 1,300 | 1,200 | — 100 |
| „ Italy ... ... ... | 3,900 | 3,800 | — 100 |
| „ Austria-Hungary ... | 3,100 | 3,200 | + 100 |
| „ Russia in Europe ... | 2,500 | 3,900 | + 1,400 |
| „ Sweden ... ... | 2,500 | 1,100 | — 1,400 |
| „ Argentine ... ... | 2,600 | 1,800 | — 800 |
| „ Chile ... ... ... | 1,500 | 660 | — 840 |
| „ Japan... ... ... | 1,260 | 870 | — 390 |
| „ Uruguay ... ... | 1,200 | 320 | — 880 |
| „ British S. Africa ... | 900 | 620 | — 280 |
| „ Other countries ... | 6,790 | 7,130 | + 340 |
| Total ... | 36,900 | 34,000 | — 2,900 |
| *Electrical Measuring and Recording Instruments.—* | | | |
| To Great Britain ... | 220 | 340 | + 120 |
| „ Italy ... ... ... | 680 | 900 | + 220 |
| „ Austria-Hungary ... | 770 | 900 | + 130 |
| „ Switzerland ... ... | 250 | 240 | — 10 |
| „ Denmark ... ... | 180 | 140 | — 40 |
| „ Sweden ... ... | 410 | 210 | — 200 |
| „ Russia in Europe ... | 390 | 610 | + 220 |
| „ Spain ... ... | 320 | 330 | + 10 |
| „ Argentine ... ... | 190 | 320 | + 130 |
| „ Other countries ... | 1,290 | 1,610 | + 320 |
| Total ... | 4,700 | 5,600 | + 900 |
| *Carbons, Brushes, &c.—* | | | |
| To France ... ... | 1,200 | 800 | — 400 |
| „ Switzerland ... ... | 1,100 | 500 | — 600 |
| „ Austria-Hungary ... | 1,500 | 1,200 | — 300 |
| „ United States ... | 2,500 | 5,500 | + 3,000 |
| „ Great Britain ... | 6,100 | 5,000 | — 1,100 |
| „ Italy ... ... ... | 2,500 | 2,100 | — 400 |
| „ Other countries ... | 8,200 | 8,400 | + 200 |
| Total ... | 23,100 | 23,500 | + 400 |

## OUR LEGAL QUERY COLUMN.

*[Questions addressed to this column should be written on one side of the paper only.]*

"W. E. S." writes:—"Two braided aerial lines have been erected entirely on private land for the purpose of supplying power at 220 volts. Passing over are a number of P.O. telegraph and telephone wires at right angles to power wires. Has the owner of the power lines to fix guard-wires over his cables, and bear the expense of fitting fuses, &c., on the telephone and telegraph lines?"

*** The question raised in the above query may be answered by reference to the Electric Lighting Act, 1888. Before that Act the Postmaster-General only had power (by virtue of the Electric Lighting Act, 1882) to demand that his lines should not be injuriously affected by wires laid under and by virtue of a provisional order. By the Act of 1888, however, he may call upon the owner of any line which is "injuriously affecting" his telegraph lines to take steps to protect him. But what is "injurious affection"? By Sec. 26 of the Act of 1882, a telegraph line is deemed to be injuriously affected by a work if telegraphic communication by means of such line is, whether through induction or otherwise, in any manner affected by such work, or by any use made of such work." It would seem from this that the Postmaster-General has no power to compel the erection of guard-wires. It is understood that where wires cross at right angles there is no danger to be feared from induction.

## THE QUACK IN THE ELECTRICAL MARKET.

By DOUGLAS SUTHERLAND MARTIN.

Prettyboy was an electrical engineer; that is to say, he had spent three years at college, had hung about works in the Midlands for another five, and was now waiting for something good. By way of passing the time he applied himself to the interesting occupation of foisting upon a diffident public certain worthless articles remotely connected with engineering—such as sparking plugs that would not spark, revolution counters which would only read while he held them in his hand and jockeyed with the spring at the back, and lamp-holders which had as much tenacity in them as an india-rubber monkey.

He rented two rooms and a cupboard at the top of a block of buildings in High Holborn, and called himself "The United International Electrical Manufacturing Co., Ltd." He slept in one room, interviewed possible partners in the other (hence the name "office"), and kept the stock in the cupboard. As he would airly remark to a friend, "Turned myself into a company, you know. Simply had to, to protect myself, you know. . . . Yes, good name. Thought it out myself. . . . Capital? Oh, of course, that varies. I pay for the rooms by the month, you see, so that brings it down a bit at times. We were doing rather well a few weeks ago. I sold a couple of sparking plugs and a 'Nokkit' gas-lighter in the same morning. . . . Initial capital? Oh, I raised a tenner from an uncle of mine, and tapped various other sources, and shoved 30 quid odd in myself. We had about £43 after buying what's in the cupboard."

That is how he would unburden himself to a College pal. If his interviewer were a possible partner, or a likely client from the diffident public, his manner was rather different. He would with dignity point to the chair (5s. 11d.) opposite an elaborate picture of some German machine shops. He would adjust his glasses, toy with a slide-rule, and offer the chap a pamphlet.

"Of course," he would say in his most impressive manner, "we are kept pretty busy. Owing to the rapid revival of trade consequent upon the recent speech of the American President" (or the death of the Shah, or the new Bulgarian Tariff), "I am compelled to lay down fresh plant every month, and I badly need extra help in the executive offices. Though it is a constant strain, it nevertheless means increased efficiency if one can give close personal attention to all the details of a business such as ours. I am, nevertheless, thinking of engaging a partner, a man whom I could trust, a man such as yourself."

Here Prettyboy would cough, and see if the other chap was going to say anything. If he wasn't, Prettyboy would resume.

"A man may endeavour to obtain a position with our firm. In entering such a firm as the United International Electrical Manufacturing Co., a firm, it is true, with a considerable manufacturing business, but a firm, also, with an established connection in buying and selling, the advantages accruing to the individual in question are obvious. We are happy to confer such advantages, merely stipulating that in lieu of bringing a fresh connection to the concern, the newcomer shall purchase, say, a couple of hundred shares in the company, thus obtaining a real live interest in the business; also," but this he muttered to himself, "about quadrupling our beastly capital."

At this point the victim would grow rather red and mutter something about having already invested his capital. If Prettyboy gleaned that the chap really hadn't any brass at all, he would simply close the interview, and bring out about thirty circulars and pamphlets. While the chap was reading them, Prettyboy would go to the cupboard outside, bring in some of the stock, and show him how it worked; offer him a cigar, show him to the door, and fairly load him up with untruthful literature. Then he would go back to the office, smoke a pipe, and wait for the order or orders which generally followed.

One day Prettyboy thought he would do Tottenham Court Road—a thoroughfare which hitherto had been spared bombardment by the United. So he lit a cigarette, took his bag, locked the office door, and sallied forth.

First he tried an ironmonger's. Then he sold half-a-dozen fancy spanners to a bike-shop chap (and gave him 43 circulars), and then, at the entrance to a dirty-looking tobacconist's, he saw a board up with "The Colonial Engineering Supply Corporation" on it. He thought he would try it. He inquired at the counter and was told to walk upstairs. He walked up about one hundred and fifty ricketty stairs, and again saw the sign hung out on a landing. He knocked at the door and asked for the manager. He was shown into a room which struck him as being very much like his own. Around the walls were hung flaming blue prints illustrating the wonders of engineering. Upon the broken-down old desk were 11 paper weights (he counted them) made of turbine buckets, bits of three-core cable, and sections of non-slip covers. In the chair was the manager, a sporting-looking chap of less than thirty. Prettyboy placed his bag on the floor and advanced, hat in hand.

"I have been instructed," he began, "to wait upon your firm and to bring before your notice some of the more recently introduced novelties. I represent the U.I.E.M.C., Ltd." To this statement he attributed the look of stupefaction, almost of horror, upon his listener's face, though there was hardly anything really in the bare announcement of the name of his firm to cause a chap to curl up in his chair and gasp as if he had been stung. "I specialise in the accessories department, and amongst other things I should like to show you a little device—"

"For heaven's sake, stop!" came in a hoarse cry from the chair.

Prettyboy stopped.

"You wish me to buy a worthless article?"

"You'll pardon me, Sir," chipped in Prettyboy, "but you go too fast. Sir, I am no quack. This device, as you will see—"

"You come to me! You!"

"I?"

"You, William Prettyboy!"

Prettyboy gasped. He drew back, with his hand to his head, white to the lips.

"I know you," cried the man in the chair. "Did I not work with you at college ten years ago? Do you not recognise in me Wilkins, the patent crank? Did I not help you in the labs., in the Drawing Office? Did I not coach you in hydraulics? Did I not lend you money? Ah! this is too hard a blow! After these years you come to me and try to sell me some dirty revolution counter! But hold! I will have my revenge!" He rose and walked hurriedly to a cupboard by the window, and returned with a large box. "See here!" he cried, with a horrible laugh, "here is a lampholder, which would not hold a solitary lamp on all this earth. It would blow any fuse, and having blown all fuses, would shut down any station. It is worthless. See here! Here is a sparking-plug which once took a car from Hyde Park Corner to Knightsbridge, and which will never spark again. It is worthless. See here! Here is a clock device for boiling shaving-water every morning at ten past seven. Ugh! It would never warm a thimble-full if you left it on for a month. Here is a burglar-alarm, here is a stop-watch, here is a gas-lighter. Take the lot! Take them and hang the things round your bedroom to show you the worthlessness of your calling, you ——."

He sank back into his chair exhausted. Prettyboy took advantage of the lull.

"But, say, how did you come by those articles?"

"Bought 'em!"

"Where?"

"Some in Birmingham, some in the East End, some imported, some——"

"And you are selling them?"

"Trying to!"

"So you are in the trade?"

"What trade?"

"The noble trade of bringing before the notice of the public at immense expense articles which cannot fail to be of universal service as time-savers, as money-savers, as ——"

"Oh, help!"

"As money-savers, as ——"

"Man, I recite that creed every day, and I am not the only one. There are thousands at it. College men, driven out of work by the competition, loafing for two years, then taking up anything that offers. If nothing offers they try Canada, or else set up as "The United Internationall All-British Electrical Fundamental X Y Z."

"We're pals, anyway, Wilkins?"

"We were—once."

"We are, man. Let's amalgamate!"

"What's the use?"

"Double the capital; increase your plant. If you haven't any plant, buy some."

"Start a young works, you mean?"

"Yes, and make the stuff ourselves. We'll call it 'The United ——'"

"'The Colonial,' if you please!"

"Oh, anything! The United Colonial, British, Foreign and International Electrical Mechanical Anti-Vaccination Manufacturing Corporation. Head office and works ——"

"The workhouse, old man!"

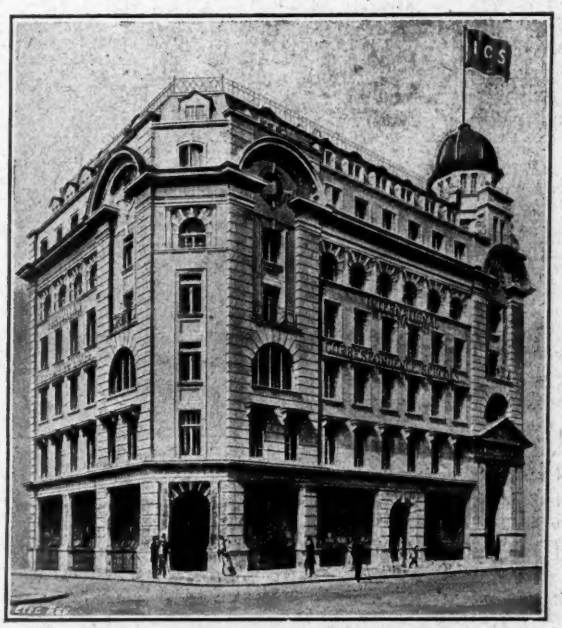
## TUITION BY CORRESPONDENCE.

ALTHOUGH no one will maintain for a moment that any means of instruction can possibly be as efficient as that which involves the personal attendance of the pupil in the presence of his teacher, and, in the case of technical and scientific subjects, practical work in the laboratory, there can be no doubt that where oral instruction is for any reason unobtainable, tuition by correspondence forms a very effective substitute. Of this fact we have not only abundant evidence, but also personal knowledge; we speak, therefore, with the confidence born of experience. It is true that in this as in every profession, there have been instances of inefficiency and incompetence which have brought down upon the system undeserved reproach; but these abuses are apt to provide their own remedy, and our remarks are intended to apply only to those institutions which are conducted on sound lines by honourable men with a staff of fully qualified instructors.

Tuition by correspondence is no new thing; it has been practised in this country for nearly 20 years to our knowledge, on a large scale, and with a highly organised system. We have in mind in particular an undertaking which has for many years prepared non-resident students for the examinations of London University, with marked success, and there are several institutions engaged in the instruction of students of engineering. It is with one of the latter that we are especially concerned in this article.

For several years past the International Correspondence Schools, an institution which came into existence some 18 years ago in the United States, has had a branch establishment in London, which has quietly been developing an extensive connection, and laying the foundations of a wide-spread organisation. Instruction was at first carried on with the aid of the admirable text-books and scheme of lessons evolved in connection with the system in the United States—where the business had grown to such an extent that a fully-paid capital of over £2,400,000 was engaged, and the roll of past and present students numbered over a million. It was soon found, however, that while there was abundant scope for the Schools' activities in this country, their progress was hindered by the very marked, if not important, differences between American and British practice. With characteristic energy and enterprise, the directors decided to create a new series of text-books, written by British experts, and based entirely on British practice; at the same time it was resolved that a headquarters should be erected in London worthy of the magnitude and importance of the undertaking, and early in 1909 the International Correspondence Schools, Ltd., was formed with a capital of £200,000 for this purpose. Since that date rapid progress has been made. A large and handsome structure—"International Buildings"—has been erected in Kingsway, the greater part of which is devoted to the work of the Schools; the new text-books have been hurried forward towards completion at a rate never equalled even in America, the output averaging 100 pages a day *continuously*, and a "field staff" has been called into existence with upwards of 40 branch offices in the United Kingdom alone; the London establishment, however, deals with the whole of the British Empire except Canada, which of course is more conveniently worked from the American centre, and branches have been established in all parts of the Empire. It will be seen, therefore, that the I.C.S. must be regarded as a new and important factor in the education of the British worker.

The question naturally arises, and very pertinently, whether the work of the I.C.S. is or is intended to be in competition with that of the many technical colleges and schools that are scattered throughout the country. The answer, on the authority of the organisers, is emphatically in the negative. It is at once admitted that where a student is in a position to attend in person properly organised courses of instruction, it is preferable that he should do so. But there are innumerable instances in which this course is impossible. The exigencies of his business may require a student to move about from place to place, or his hours of work may be such as to preclude his attendance at regular classes. Again, many a man, while willing and anxious to improve his knowledge, is unable or reluctant to sally forth from home at fixed hours after his day's work is over, though he will readily settle down at home to study for an hour or two. There is also a very large class of men




INTERNATIONAL BUILDINGS, KINGSWAY.

who cannot associate with their own subordinates and apprentices at evening classes without serious loss of prestige, or of dignity—real or imaginary—yet who would, and do, eagerly avail themselves of instruction such as that provided by the I.C.S., for they realise that the younger generation is growing up with higher scientific and technical attainments than they themselves possess, and that they must take steps to prevent their being outstripped in the race of progress. Even highly placed officials have taken and are taking the I.C.S. courses, and students who have taken the diplomas of first-class colleges find that they can with profit pursue their studies in some special branch of their profession with the aid of the Schools. The work of the latter, therefore, is to be regarded as complementary to that of the technical institutions, and also as supplementary to it, but not as competitive.

One great advantage possessed by a correspondence institution is due to the character of the students who take up its courses. None but earnest, dogged and industrious workers are either willing or able to plod through the curriculum and obtain the certificate awarded to the succesful

student who has satisfied his teachers that he has done justice to the courses prescribed and has assimilated the instruction provided. To this fact we are disposed to ascribe many of the successes claimed for their pupils by the I.C.S. and similar organisations; they have the very best material to work upon, and character combined with knowledge is bound to make a way for itself. It is not alleged that every student who commences a course perseveres to the finish—

Male Staff of the I.C.S. Headquarters.

such a contention would be too Utopian for belief; it rests with the student to maintain his efforts without ceasing, and the reward is to him who deserves success by commanding it.

These comments and reflections are prompted by a visit which we recently paid to the headquarters of the I.C.S., for the purpose of investigating the aims and methods of the schools. We were not unfamiliar with the main features of their work, for we have watched their progress for years past; but the new developments appeared of sufficient importance to justify a closer acquaintance with them. Our observations satisfied us that the organisation of the system had been carried to a remarkably high pitch of excellence, and that the methods of carrying on the work were efficient and thorough. Although the dispatch of lessons in rotation is carried on almost mechanically, with the aid of elaborate card indexes, the examination of the solutions of problems and of the answers to questions sent in by the students is performed with minute and painstaking care. It is not sufficient for the right answer to be given—every step in the working is checked, and any error is at once detected and brought to the notice of the student. This, be it noted, is absolutely essential to the inculcation of correct ideas and the

Record and Mailing Department.

avoidance of a fictitious impression of progress on the part of the learner. Not only are the regular papers thus individually revised, but also any questions that the student may put forward in connection with the subject he is studying are conscientiously replied to by the instructors, and students are encouraged to ask such questions. Backward students are placed in the charge of special instructors, whose task it is to accelerate their progress by individual attention and instruction. The full record of every student is always accessible on file, and he is visited in person at regular intervals by the local field staff, no matter where he may reside, so that he is constantly kept up to his work and in intimate touch with the schools.

There are some 17 "Schools," or subjects, embracing all the principal branches of industry, and these are sub-divided into 200 different courses of instruction. Each course is complete in itself—for instance, if electrical engineering is taken up, the necessary amount of mathematics, physics, chemistry, &c., is included, *ab initio*, and it is stipulated that unless a student can show that he already possesses the required degree of knowledge in the associated subjects, he must work through every branch of the course prescribed. Besides receiving a complete set of the text-books necessary to his course of instruction, the student is supplied with a duplicate set in the form of separate lessons, which he can therefore carry in his pocket, and otherwise subject to hard wear, without compunction. In the Mechanical Engineering course alone, which has cost £10,000, there are 131 of these pamphlets, comprising 6,300 pages and 3,851 illustrations. He is also provided with a simple but sufficient set of instruments (in the case of a course in drawing, for example) and with apparatus for carrying out elementary experiments in such a subject as electricity and magnetism. But we cannot enter further here into the details of the system. We have read students' answers, seen them corrected, and watched the staff at work filing, correcting, dispatching, accounting, writing text-books, illustrating them (every illustration is redrawn for reproduction by a specialist), editing, &c., and we can only say that any person who feels any doubt as to the stability, *bona fides*, efficiency or magnitude of the undertaking had better pay a like visit to the headquarters. He will be convinced. We give a few illustrations of the I.C.S. establishment in Kingsway, where a floor area of 14,600 sq. ft. is allotted to the work, and a staff of 172 persons is employed.

## THE MURRAY PHOTO-PRINTING SYSTEM.

(*Concluded from page* 485.)

In the experimental model of this instrument provision has only been made for the exposure of a comparatively short length of photographic paper, which is afterwards developed and fixed separately. In the machine for commercial use a continuous roll of photographic paper, together with developing and fixing tanks will be provided.

This new machine is believed by the inventor, Mr. Donald Murray, to be specially suited for working on submarine cables in conjunction with the Brown cable relay.

For such an instrument as has been described to be commercially useful for Press work, some means of manifolding the messages is necessary.

## THE TROLLEY OMNIBUS.

Those who attended the recent Municipal Tramways Convention had an opportunity, on the last day of the conference, of inspecting the very first demonstration line in this country of the system of rail-less electric traction, numerous instances of which, however, have for some years past been successfully at work on the Continent, where conditions are more favourable to the fostering of new methods, either because restrictions are absent or the spirit of adventure is higher—perhaps both.

It is, at any rate, very noticeable that while substantial working progress has been made with this new system in France, Germany and Austria, there appears to be some difficulty in this country in convincing private capitalists or public officials and municipalities that this is a sound proposal with great economic advantages and able to occupy a large field with satisfactory results.

Even those who have been brought to see the uses and advantages of the rail-less trolley appear to be waiting one upon the other to take the first steps—we will not say for the purpose of profiting by the possible mistakes of others:

it is rather a case of letting "I dare not," take the place of "I would," or who shall "bell the cat?"

True, there is this to be said for delay in pushing on: no one seems to know the exact measure of power which official red tape can exert over the development of this new method, or which Governmental department is to supervise it and how far. It may be the Board of Trade, or the Local Government Board, or the Home Office, or even the new Department which is to look after new or improved main roads, and will therefore have an eye on all possible sources of revenue. Parliament itself may have to be consulted by means of Provisional Order or Private Act, for the installation of a rail-less trolley system implies the securing of powers to erect overhead wires and poles carrying electric energy along public roads, and also to enforce the payment of fares by passengers, unless the provisions of Hackney Carriage Acts and similar enactments can be made to apply.

So far as the technical or engineering aspect of the movement is concerned, there is no such ground for criticism. On the contrary, substantial progress has been made, and this could be clearly seen at the demonstration above referred to, when the members of the Tramway Conference inspected the experimental line installed by the Railless Electric Traction Co., Ltd., in the depôt at Hendon belonging to the Metropolitan Electric Tramways, Ltd.

Here was shown a line—perhaps ½ mile or so long—equipped as for actual work, and embodying a great many additions and refinements not to be found on the Continental lines, but considered necessary in this country, where higher standards of work are called for.

The overhead work is, of course, different very materially from that employed in tramway service, seeing that both positive and negative conductors are overhead. The wires for this purpose are set fairly close together—about 11 in. centres—so as to reduce as much as possible the size and weight of the double collector attached to the car.

This is of the under-running type, as in tramway work, kept up by means of springs at the base on car roof; but seeing that the car is not confined to one track, but must draw in and out of other traffic, the double collector pole has a lateral swing up to 90° on each side, also controlled by springs.

The form of collector at present employed is practically a small inverted four-wheeled round frame, pivoted at the centre for horizontal movement and at the side for vertical play. It has, therefore, a universal movement to allow for uneven roads, &c.

A pair of wheels, placed tandem, runs under each trolley wire, and two separate poles, with hinged tops, serve to carry the collector frame, their bases being secured to the car-roof fitting through springs, as above mentioned.

While this is the arrangement so far at work, the Railless Electric Traction Co., Ltd., have an alternative method, which employs three wires overhead, the two outside ones being positive and the centre one—placed at a lower level, so as to make sure of prior contact—being negative and permanently connected with the whole framework of the vehicle.

As india-rubber tires are, of course, employed on the car-wheels, the whole car is insulated from the earth. If, as will often be the case (where, for instance, the trolley omnibus runs on a route which forms an extension of electric tramways), the supply of current is from the usual 500-volt circuit with earthed return, it is absolutely necessary, in order to prevent possible shocks to passengers, that the car framework and fittings should be carefully and continuously earthed.

Tramway engineers are familiar enough with compensation claims for shock to passengers, and in some of these it is quite possible that owing to dry rails, perhaps covered with dust and sand, the whole four wheels of a tramcar may be insulated from the rails just at the instant when some unfortunate passenger, getting off or on the car, touches a brass platform stanchion or other metal part of the car, and so gets a more or less severe shock, which a clever advocate will invest with a well-nigh fatal importance.

To prevent the possibility of this, the Railless Traction Co. have devised the triple trolley head and triple trolley hanger; the three trolley wires in this case consist of two outer positives—13½ in. centres apart—and the middle negative at a lower level, so that the triple trolley head cannot make contact with the positives before doing so with the negative.

Unless, however, the Board of Trade or Parliament, or whoever the authority may be with power to settle these details, should insist on such provision, there does not seem to be quite sufficient reason for the excessive precaution. Good motor and circuit insulation has proved quite satisfactory on the Continental lines; and rather than see three overhead wires, it might be preferable to have a separate and distinct source of energy for the rail-less trolley system with the negative insulated from earth altogether, if that be possible or permissible.

As an additional precaution against possible short circuits to the car-frame, the Railless Traction Co.'s equipment provides each car with a visible or audible leakage indicator, which continues to act and give warning until the circuit is broken or the leak found and set right.

The type of vehicle employed on the demonstration line at Hendon is probably one that will have a permanent use. It has a single-deck body, with seating capacity for 22 passengers inside, and two additional seats on the rear platform. This body is mounted on a special chassis or frame which carries two separate 25-H.P. B.T.-H. railway motors mounted with their spindles parallel to the car frame.

These motors each drive one-half of a cross-countershaft by means of bevel gear; on the outer ends of the countershaft are chain wheels which transmit the drive through separate chains to the road wheels.

The latter are, therefore, independently driven—one by each motor; and no differential is required. In the other design standardised by the Railless Traction Co., one motor only is used, and a differential gear is then required. The former method has obvious advantages, and is on the whole to be preferred.

Control is of the usual kind, employing grid resistances, and in the two-motor equipment series-parallel working is also used, but the company point out that this is not so important with rail-less cars as in tramway service, the demand for energy with the former being more continuously heavy, and not merely so at starting.

It would be interesting to test in such work as this the type of commutation-pole motors with variable field strengths, now being designed for special power duty by many of the leading makers.

The question of current consumption is, of course, a very important one, but can hardly be dealt with in this brief notice; if only for the reason that, as energy for power purposes may now be obtained for very little, if any, above 1d. per unit in the majority of cases, an increased consumption for rail-less cars of even double the average on a tramway (owing to the greater road resistance) is easily outweighed by the absence of the cost of maintenance of the track no longer required, together with the saving in interest as compared with that on the much larger capital outlay for a tramline.

This fact is by now pretty well admitted, otherwise the rail-less car would still have to justify itself from the engineer's standpoint.

There are, of course, some comments permissible upon the car itself. It is possible that this new system of traction will offer some opportunity for a *six*-wheeled car to prove what it can do.

By driving on the middle pair and steering from the front and back pairs—interconnected in a suitable way—the weight should be much better distributed, there should be no fear whatever of side slip, and the steering itself, while apparently more difficult or hard, should really prove very flexible.

The six-wheel frame has been tried with petrol vehicles, but not very successfully. It should be an easier matter with electric working, and we hope to see it done.

The passenger seats should also be fitted across the frame and not lengthways. This adds to the width of car, but that should not matter where the vehicle does not keep to a fixed track and where clearances need not be definite.

The Railless Electric Traction Co. are to be congratulated on the work they have done, and it is to be hoped that they will now have some opportunity of installing several of these lines at once in active public service and not merely for experiment.

Some of our chief local authorities have at length decided to install one or more lines as extensions or feeders to their municipal tramways, and it is to be hoped they will push on now without delay. Others will then step in with more confidence, and we shall see the traction world—for some time past almost lifeless in the direction of tramway or light railway building—again occupied with the development of a reasonably economical method of improved transit, more particularly in districts that otherwise could not hope to benefit for a long time to come from modern traction improvements.

The Metropolitan Electric Tramways have in this way shown once more that the country is always, in the first instance, indebted to private enterprise for improved methods; they are to be congratulated on it, and a hope may be expressed that the credit of thus showing the way will also be accompanied by very profitable working on any routes they may equip.

## NOTES ON TRADE ABROAD.

(*Continued from page* 568.)

Japan Leaping Ahead.

We recently alluded to the statement of S. Kondo regarding the coming electrification of railroads in Japan by the utilisation of water-power. As illustrating the important electrical advance that is taking place in that speedily-getting-into-line country, necessitating the setting up of a Bureau of Electricity (with S. Kondo as chief) in connection with the Department of Communications, we may quote from an American Exchange one or two interesting figures. In five years, it appears, the demand for electric power has been multiplied by six or seven, rising from 58,000 KW. to 380,000 KW. The proportion generated by hydraulic power has risen from 16,000 to 62,000, and permits have been granted for another 158,000 KW. Out of 817 registered manufacturing industries, 198 use electricity.

It was recently stated in the *Bulletin Commercial*, of Brussels, that there are good openings in Japan for all kinds of electrical machinery and appliances. It appears that there would be more tramway work put in hand but for the lack of capital at present. The Tokio Electric Light Co., which already has the largest undertaking in Japan, is just about to add considerably to its works and to its generating and transforming plant. The Tokio Jetsudo Kabushika Kaisha is also about to extend.

The *Times* "Financial Supplement" of October 8th contained, in its "British Oversea Trade" series, the second article on "Relations with Japan." The writer concludes thus :—

**It used to be asserted, especially in Consular reports, that British manufacturers' interests would be better served by sending direct representatives to Japan than by relying on the resident middleman. Certainly that is true with regard to highly specialised kinds of work. But in the vast majority of cases the resident middleman leaves nothing to be desired in point of industry, shrewdness and enterprise, to which qualities he adds the invaluable advantage of experience. So, too, a fashion prevailed some years ago of extolling the German at the expense of his Anglo-Saxon rival. Events have not justified that discrimination. Admirable as the German undoubtedly is in science and theory, recent records do not show that the Anglo-Saxon has much to learn from him as a practical man of business.**

India's Future Dependent upon Hydro-Electrics.

Reverting to our comments on the future of electrical enterprise in India and the important part that hydro-electric schemes may be expected to fill in connection therewith, we observe that the Indian Government has announced that there are at present no laws relating to the development and use of water power in India, and that the terms of licences granted for water-power electric schemes are settled by special agreement based on the merits of the case advanced. Our contemporary *Indian Engineering*, in discussing this matter, remarks that, although laws may be considered unnecessary at present, it would do no harm if the provincial governments were enjoined, "seeing that electrical enterprise is still in its infancy in India," to exercise due liberality in imposing terms; otherwise "it is difficult to see how it will be possible to attract capital for such schemes, the establishment of which is essential to the industrial development of India." If our contemporary had been writing on the subject in the heart of the City of London it would have been even more urgent in its advice, for it would then have known how it is practically impossible to get an interest taken in far more immediately promising hydro-electric proposals, or even cut-and-dried schemes, in Norway and other countries far nearer home than India. We hope not only that the Government, when it deals with the matter, will make the terms of concessions as easy as it possibly can, but that the raising of English capital for such projects will soon be a matter of far less difficulty. Otherwise this country, however good its hydraulic engineers may be, and however well equipped its manufacturers may then be for executing larger hydro-electric work than they have done here, will not get its share of Indian electrical development business.

Germans in Argentina.

The interest that Germany is taking in Argentina is a matter of more or less common knowledge. A Consular official in Buenos Ayres has lately reported to the American Government on one of the various ways in which this interest bears fruit. He says that every year hundreds of very highly trained young Germans—men who can speak, read, and write Spanish and English when they land in Buenos Ayres—go out to Argentina to engage in business, and nearly all succeed, because their efficient and practical training and adaptability to local conditions, combined with acuteness of mind, render them very valuable to their employers, and later give them such self-reliance that they usually succeed when in business for themselves.

What decimal point of one per cent. of the import business that they are able to influence is likely to come to the British manufacturer? While the British Isles are sending abroad far too many failures who cannot find employment here, many of them because they are unfit, other countries are sending out men well equipped for the commercial competition, and it is not surprising that they are reaping the only benefit that is reasonable as the outcome.

Call on the British Consul.

We have no doubt that British travellers could sometimes obtain a good deal of valuable assistance by calling at the British Consular offices in each town where such exist. The American Consuls are, in their endeavours on behalf of American trade, often urging U.S. representatives to call upon them. In the case of Kobé, Japan, the Consul has complained that although his office receives letters on their behalf, travellers never call, preferring to send any sort of a messenger to fetch their correspondence. He shows that often a call for advice concerning local conditions or local firms, and an interchange of opinions, might be time profitably spent. We would urge British travellers to make free use of British Consuls and Consular officers. The more they do this sort of thing, the more likely is it that pressure will be put upon the authorities at home, leading to the appointment of commercial agents at each office of importance.

Prepare for the Russian Boom.

The St. Petersburg correspondent of the *Anglo-Russian Gazette*, writing on "The Development of English Trade in Russia," emphasises the need for sending out English agents and appointing English resident representatives, but, above all, English commercial travellers. Writing on the language requirements, the writer says: "It is an erroneous idea to suppose that the only language required is Russian. In the Baltic Provinces, for instance, you will do little business unless you can speak German. In Poland the traveller must know either French or Polish, whereas, in Odessa and St. Petersburg, German, English and a smattering of Russian will carry you through, and in Moscow less of the two former and more of the latter will meet all demands. The deeper you go into the so-called Russia proper, the more Russian will, of course, be required, and in many places the mother-tongue is predominant." Later he adds: "Many Englishmen, scattered all over the country, with a good or fair knowledge of Russian and German, will be found prepared to act as pioneers and travellers for English enterprise and commercial undertakings, and their services should be of great value to those desirous of finding a market for their

capital and goods in Russia. Place your business in the hands of experienced travellers knowing Russia, and the Russian and German languages, and you will do a prosperous trade."

In the same journal there are interesting articles on "The Coming Boom" and "The Passing Hour." "Technicus," the writer of the latter, refers to the coming electrification of Finnish railways. There appears to be great activity in railway circles in Finland just now, and the question of electrical working is to the fore :—

Inasmuch as less than 7 per cent. of the 3,000 odd miles of railway in Finland is owned and operated by companies, the great bulk of the work of providing electrification will devolve upon the Government. The ultimate aim is to secure the electrification of all the railways in Finland, but for the present efforts will be limited to the line which runs from Helsingfors, through an industrial and thickly-populated countryside, to St. Petersburg, after which the important branch line from Viborg to Antica will receive attention. These initial electrification projects represent a distance of about 300 miles, and would derive their power from the well known falls of Wallinkoski, on the River Wuoksen, which is the outlet, near Viborg, of Lake Saima into the Gulf of Finland. It is stated that single-phase transmission will be adopted, and there are to be 14 sub-stations. It is estimated that when the equipment is installed and in working order, the electrification will result in an economy of more than £50,000 a year.

The writer adds :—

I have not heard which country will supply the electrical plant, but as not a fifth part of the electrical machinery and apparatus imported by Finland is of British origin, the bulk hailing from Sweden and Germany, it is very doubtful whether British manufacturing enterprise will have a "look-in" in connection with, at least, this initial portion of the electrification scheme. This is not, therefore, a matter upon which British electrical engineers can congratulate themselves. It is to be hoped that they will not fail to figure in some of the subsequent contracts, for the electrification of Finland's 3 000 miles of railway represents opportunities eminently worth cultivating.

As showing the expectations of increased trade between Russia and ourselves, it may be mentioned that there is a British movement on foot to establish a regular steamship service between the south-west of England—particularly Bristol—and the Baltic ports. A director of the Bristol Harbour Board (Mr. Hardestone) arrived in Riga last week to study the commercial conditions, as well as shipping and other matters there, and he subsequently proceeded to Reval and St. Petersburg.

The Brush in Spain.

There are Budgets and Budgets. We are pleased to observe from the last issue of the Brush Budget that the Brush Electrical Engineering Co., Ltd., is doing well in Spain. The following quotation will speak for itself :—

We have been encouraged by the growth of our business in Spain to increase the value of our Spanish agency, situate at Calle Pelayo, 12, Barcelona, by providing means for more rapid delivery of motors and other manufactures. Since her separation from burdensome foreign possessions, the improved prosperity of the peninsular has attracted salesmen of all nations to endeavour to secure a share of expanding business. It is gratifying to find that Spanish buyers are showing an increasing appreciation of the unequalled quality of British goods. Barcelona, which is the centre of Spain's busiest industrial district, has many ties with British commerce.

There is no doubt that there are many opportunities for electrical enterprise the other side of the Pyrenees. We enter on the same ground as do other manufacturers in most respects—the financial support of the Germans is one of their points of advantage—yet, compared to our own, we understand that the turnover of German electrical manufacturers in the Spanish market last year was very large indeed. Our informant could not for the life of him say why it was that British engineers were so far behind, unless want of attention to the market and lack of selling initiative were the causes. It is gratifying to quote the Brush experience that Spanish buyers are showing an increasing appreciation of British goods —is it due to the fact that they are now getting to know more about our manufacturing abilities than they did ? We hope that our electrical business there will increase rapidly from this time forth.

British-Born Consuls.

I quite understand the English standpoint and that the English feel that Anglo-German commercial rivalry makes it desirable for Britain's commercial interests to be represented by a British-born subject in Berlin. I dare say it is believed that there are occasions when a German banker, acting as British Consul-General, might be brought into conflict with British interests. I can, however, conscientiously say that during the 11 years that I have been Consul-General there has never been any clash between British and German commercial interests in Berlin.

In these and other words Dr. Von Schwabach addressed Reuter's representative on the subject of his retirement from the office of British Consul-General in Berlin. No one, with any idea of what is becoming, will attempt to consider the matter from the point of view advanced in the doctor's last sentence. We have none of us any desire to argue on particular cases in such a matter, especially when a man has retired, but the principle is a very important one for all interested in British trade welfare abroad. The mere fact that Dr. Schwabach having occupied the office, can quite understand our agitation for British-born representatives in foreign countries, is enough for us without any labouring of the point. We hope that the decision of the Government to appoint Mr. Harry Boyle as the first paid British Consul-General is the beginning of a new policy which shall ensure British care for British commercial interests. The wrong policy of the past has been allowed, though not enthusiastically approved we believe, by the Foreign Office, on the score of economy—that is, British trade interests have been in the more or less zealous care of a German because the United Kingdom desired to save a few thousands a year. It has been a penny wise and pound foolish policy, and we hope that the present action heralds the approach of a saner condition of things. We cannot imagine any Cabinet with business men in it allowing the old order of things to continue for six months after their taking up office—that is, assuming that those business men knew what was being done by Consuls of some other countries to help our foreign rivals. The ELECTRICAL REVIEW has already asked for a further half-a-million a year to be expended upon the British Consular service with a view to making it equal to, or better than, that of other countries, and rendering it of such value as it ought to be to British manufacturers at home. We observe that a correspondent of an evening paper is hoping for other reform, such as permitting Consular agents to write articles for the trade Press. This may be open to argument.

Foreign Trade in September.

The gradual improvement in our foreign trade continued during the month of September. The imports increased by £1,458,891, and the exports by £1,179,818 on the corresponding months of 1908. The re-exports advanced by £1,176,329. The increased exports consisted chiefly of manufactured articles. There was a considerable fall in new ships, owing to special items coming into last year's return, and a decrease of £88,538 in machinery, but iron and steel goods showed an improvement of £242,507. Last month we showed that the total of electrical goods and apparatus (other than machinery and telegraph and telephone wire) exported during the eight months was £239,932 better than in the similar period of 1908. We are now told that this item for the nine months is £246,348 better than in 1908, so that the month of September shows a continued, though small, improvement of its own amounting to £6,416. As a matter of fact, the actual figures were £151,800 for the month, against £145,384 in September, 1908.

The Buenos Ayres Exhibition.

We learn from our contemporary the *Railway Gazette*, at whose offices at Westminster the Buenos Ayres Exhibition Department is giving out particulars regarding space, that many leading British electrical and engineering firms have already signified their intention to display their manufactures at this Exhibition which is to be held from May to November, 1910. The enormous extent of the market and its promising nature, has led a number of firms to take this enterprising step with a view to getting a good foothold for British manufactures or strengthening whatever hold they already have. The list of names given by our contemporary includes such firms as British Westinghouse, Crossley, Chloride Electrical Storage, Dick Kerr, Hadfields, Mather & Platt, Rashleigh Phipps, Veritys, Applebys, Stothert & Pitt, Robey, Saxby and Farmer, Broughton Copper, Joseph Booth, Alfred Herbert, Hick Hargreaves, J. E. Hopkinson, Vickers Sons and Maxim, Worthington Pump Co., &c. The list for space does not close until December 31st, but the firms named are a sufficient indication that British electrical and allied firms

do not intend to allow to slip through their fingers this splendid opportunity of making a thoroughly representative showing in what for many years to come will be a market well rewarding rational efforts that may now be made. In the past month's trade returns mentioned above the advance in iron and steel exports is largely accounted for by increased orders from the Argentina market for railway iron. We look for a continued increase year by year now in this direction, meeting the railway constructional requirements of these and other foreign territories which are in the throes of development demanding transportation facilities as a first aid in their efforts. Where the electric railway goes the electrical engineer is in at the beginning, but where the railway is steam the demand for all sorts of electrical service and appropriate manufactures comes only a little later. We are delighted that our firms are intent on securing this market now.

From Buenos Ayres to Chile is not a far cry, a few hundred miles across country, and the kind of development that is taking place there just now may be gathered from the news recently announced in our pages that the Chilean Government has decided on the electrification of 1,150 km. of railways beginning with a modest 184 km. as an experiment. It was stated last week that an American financial house had made an offer to the Government to lease all the State railways at an annual rental amounting to 3 per cent. on the capital invested. It was added that the proposal was being considered. We hope it will rest at that, for if trade once followed the flag, it more often nowadays has a knack of running in the wake of finance—when the money is found by countries other than our own!

**Tramps Abroad.**

With reference to our comments of last week on foreign travel, it will be fitting to introduce here some lessons that the intending traveller to the South American market should learn before he steps out. No one set of advices can be given which will be applicable to all markets, but there is a good deal in what follows which may be useful for general guidance, although the comments are based upon the contents of a report which was prepared with special reference to South America. American Consul Chamberlain reviewing the trade-getting methods of American Commercial travellers in Pernambuco district, frankly told American firms that they did not understand how important it was to have good men. Cheap travellers "invariably turn out to be expensive, and often permanently ruin a market for the careless firm that employs them." Some of the men were engaged, apparently purely because they could speak Spanish, but "their ideas of business methods in general were hazy and they were absolutely ignorant of the simplest formulæ of foreign trade"—yet they represented firms well known throughout the United States! We need not enter into details of the amusing blunders they committed in their journeyings from place to place, raising a loan here and another there, because of short-sightedness in arranging credits at home, and at times—though representing leading U.S. firms—being in "absolute distress," "penniless"; another went with a fine lot of samples and $1,000, but owing to the duties on his samples absorbing as much as $600, a pretty chapter of accidents followed, to his own and his employer's discredit, because of insufficient knowledge or calculation in advance. Consul Chamberlain says the following considerations must be weighed by inexperienced houses who wish to establish or increase their trade in Brazil:—

There is an abundance of trade here always, and that it is worth going after can easily be seen by studying the statistics showing the purchasing power of the country. To secure a share in this trade it is absolutely necessary to send representatives. A deaf and dumb person, however, who knows how to do business and keep cheerful, is a far better representative than a linguist who never saw a letter of credit or an order blank.

American firms in arranging to send a man to do $50,000 worth of business should not send one whom they cannot trust with a letter of credit for $3,000. Remember that a man who travels through South America and keeps his expenses down to $10 a day is doing it cheaply. A book-keeper on the Amazon gets $500 gold a month and finds it difficult to live within that income.

If the representative of a firm is to be away more than a year, he should give bond. It will steady him and his principals will not be so reluctant to back him up when he needs help in an emergency.

People, customs, banking systems and business ways are different in South America from those that obtain in the United States. A traveller in his first trip encounters new and peculiar circumstances, and if he is harassed by improper and insufficient connections with his base of supplies he will fail, and South America will be regarded as being too "pioneering" and too expensive, when the truth is that a cheerful word from home and prompt backing would have saved the situation even after a bad start. It must be remembered that the traveller is on the spot and dealing with a network of trade regulations that are not experienced in the United States. When he lands, the Custom House holds his samples until the duties are paid, and they have to be paid in a certain way; sometimes it takes three days, and it always requires a professional despatcher. When he gets on shore, a revenue officer calls for the local tax on commercial travellers. This tax varies in different cities from $10 to $400. Besides these details, he will find railways with triple baggage rates. One man paid $50 gold on his baggage from Sao Paulo to Rio de Janeiro, a distance of about 300 miles, only to find later that there is a special scale for sample trunks that would have cut the bill two-thirds.

If one has a good representative who does not talk Portuguese, a line of samples may be given him that will do the "talking."

**Suggestions for the "Commercial."**

For the guidance of the commercial traveller about to visit South America the following schedule of suggestions is offered by Consul Chamberlain:—

"Do not start out before you are an experienced salesman. To be able to take an order automatically, and take it right, is an essential—just as necessary as to be able to get the order. A slip of the pencil or a little misunderstanding as to terms has often permanently lost a good customer.

"Your salary and an average of $10 gold a day for expenses is the least you can work on comfortably.

"Map out your trip before starting, remembering always that your time is not money to the people you are going to deal with, and that if you are going to try to hurry them you might as well stay at home.

"If you have five days in a town, spend three getting acquainted. You will find that many a merchant who is altogether overstocked when you first see him, if he takes a liking to you, after a few days will find several empty shelves.

"If it is your first trip, call at the Consulate at once. You can save time by learning there how to clear your baggage, where to put up, by getting a list of firms buying your line and by learning on what days you can get boats or trains to the next port, &c.

"If you are empowered to give credits, arrange introductions from the New York branches of the South American banking systems to their different managers. Three concerns would cover the whole coast, east and west. On the east, either the London and Brazilian Bank, London and River Plate Bank, or British Bank of South America. On the west coast, the Grace system. Consuls are not allowed to give any opinion on the financial standing of firms or individuals, and for such information you will be more or less dependent upon the banks. A letter of credit is the best kind of introduction to a banker.

"Do not start out with the idea that you can wire for money at any time. Counting in the charges for cabling and bank discount it costs between $20 and $25 to send $100 to any town in this district, and even then there are few firms at home that know how to go about it.

"Keep up your spirits. A quiet cheerful salesman can place an order in an overstocked house when a gloomy man finds it hard work to draw an order from a merchant who needs the goods. Business is not always exclusively business here—sympathy is apt to be mixed with it."

**Points for Brazil.**

In his report on the trade of Brazil last year, the secretary to H.M. Legation at Rio de Janeiro insisted strongly on the necessity for using the Portuguese language in British catalogues, and he added that a good knowledge of the same language by representatives of British firms would be invaluable, though where this was not possible a competent interpreter should be secured. In the case of machinery business the traveller must be an engineer, or else have a practical knowledge of the working of the machinery he is trying to sell. Among other reasons for this is the fact that he may sometimes have to discuss the goods with the foreman or manager in a technical manner, with men who would regard him with more or less disdain if he were unable to discreetly talk of and explain what he wanted them to buy.

(*To be continued.*)

**New Financial Company.**—The Thomson-Houston Co., according to *La Lumière Electrique*, is going to establish, with the assistance of the principal financial firms of Paris, foreign banks, and the Metallgesellschaft, a company with a capital of £200,000, called the Société Centrale d'Industrie Electrique, with the object of creating throughout the world companies of all kinds using electricity, and of taking part in all projects of the same description.

**Belgian Enterprise in Russia.**—*La Lumière Electrique* states that out of 1,412 km. of electric tramways in Russia, 1,169 km. belong to Belgian companies, the remainder being in the hands of municipalities.

## TARIFF REFORM.

By R. M. M.

The valuable tables published by the Electrical Review are of great interest to those of an inquiring nature. Are they also a guide to the personality of different station engineers, their committees or directors? The multiplicity of different rates of charging is broadly expressed in many cases by "maximum demand." Take the printed rate without inquiry into method of charge, and we see more and more stations adopting the same figures for the high units—that is a step towards standardisation. A common basis of charging is next wanted, be it 365, 400, 300, or 600 hours at maximum demand, and it will be possible for lamp makers and others to give on their pamphlets useful costs which do not give the consumer a lot of trouble to arrive at a true comparison for his district. One realises—in time—that a consumer, unless he is an engineer, is a lazy person as far as electricity and calculations go; 1,000 hours do not represent much to his mind, and 1,000 hours at 3d. is valueless to him for comparison; he *might* know that he averaged 3½d. per unit per annum, but would he know that his house averaged 850 hours or so per annum?

Now, with a common basis of charge for maximum demand towns, say, 300 hours at 7d., and the remainder at 3d., 2d., or 1d., it is fairly easy to make proper comparisons and to give "prospective" consumers a better idea of what they are likely to pay.

One set of rates which do not appear in the tables, but which are a subject of curiosity to many, are those dealing with arc lamp lighting. There are towns in which it is possible to obtain 5,000 c.p. for 2½d. an hour, however small the remainder of the installation be—that is a good stiff proposition for the gas people to be up against. For this reason, and from the point of view of the business department, it is all right, but how can an encouragement to burn lamps on the peak load help a station? To be paradoxical, the same stations very likely will have a "maximum demand" system of charging for incandescent lighting. Is the explanation that the peak load has left the evening for good and all, and what used to be peak is now hollow, or is it that there is any amount of spare plant?

Again, with regard to power, we see rates given as, say, 1½d. to 1d.—the bare statement looks quite promising, but when be begin to work out figures! One reduces his charges according to quantity alone; one by discounts based on load factor (taken by means of the maximum demand indicator); one charges two rates based to a certain extent on load factor, but mainly on time; and the next, *horribile dictu*, even bases his charges on load factor obtained from units and horse-power installed. The last-mentioned basis gives power engineers a pleasing exercise for brains—to circumvent the tariff, make things pay, and gain more consumers.

An imaginary case may be quoted. At a mill the subject of motors comes on the tapis, and is very favourably received. The firm wish to go systematically in for the maximum possible efficiency and saving obtainable by means of electric driving. Of course, a number of motors, one to each large machine, and grouping for the small machines, is discussed and considered very satisfactory; then the question of price from the supply station comes up—the tariff is based on units per horse-power installed.

Most engineers know the diversity factor of their own district, and that likely to be obtained in a large mill. How can a mill obtain a low price on a tariff based on horse-power installed, and at the same time obtain the maximum saving, unless the tariff is very liberal indeed, and only in effect considers, say, 50 per cent. of the horse-power installed?

The power engineer who has done all the spade work for the mill job cannot see his way to reduce the cost of driving to show a profit, and either "fakes" the tariff or throws up the job; the manufacturer, who has given the estimates, is only human and does not wish to see the job fall through, and so, after allowing the station some time to reconsider the tariff basis or to "fake" it, steps in, suggests and books the order for a dynamo driven from existing steam plant. This case is partly imaginary, perchance, but part is founded on fact.

One method which suggests itself for dealing with such a tariff is for the power engineer to specify motors capable of standing 50 or 100 per cent. overload continuously!

## THE TRAINING OF ELECTRICAL ENGINEERS.

The Engineering Session at University College, London, was opened on Wednesday afternoon, the 6th inst., by a lecture upon "Electrical Inventions and the Training of Electrical Engineers," delivered by Prof. J. A. Fleming, D.Sc., M.A., F.R.S., the chair being occupied by the President of the Institution of Electrical Engineers, Mr. W. M. Mordey. The first part of the lecture was devoted to a statement of the rapid growth of the industry since its practical commencement about the year 1837, its gradual division into various branches, and a reference to the large sums of money now invested in electrical enterprises.

A good general education was a necessary preliminary to a successful engineering career, and the lecturer did not favour the introduction of engineering courses into ordinary public school work. He would rather devote what time was possible to gaining a knowledge of modern languages and good English diction. In choosing an engineering career for his son, a parent should not be decided merely by a liking for taking part in scientific experiment; a sound constitution, and the possession of ability, coupled with determination and perseverance, were also necessary. On entering college a student should first be trained in the principles of pure science, and afterwards, in the laboratory, taught how to apply those principles to technical work. An engineering degree might be useful, but was not essential. The main thing was to acquire a thorough general knowledge of engineering work, and, in his opinion, a year's practical works training interposed between the second and third year's college courses was often very useful.

Towards the close of a student's course of training it was necessary that he should consider in what direction he should look for his life's work. The Post Office were offering a few appointments for highly trained workers, wireless telegraphy offered a wide scope, electricity supply, traction and lighting was another and electrical manufacturing a fourth—if, at present, rather overcrowded—field. Each of these wanted special qualifications, and no one man could be an expert in all, but all more or less needed in addition to scientific knowledge and technical skill, commercial experience. The engineer of to-day was not merely the man who did things, he was the man who did things in the best way at the least cost, and business training, which could only be obtained after leaving college, was essential. Tact in dealing with men, the power to determine whether the results to be obtained from a given outlay would compensate for the risk, organising ability—these powers were developed in after life, but were needed for success in the higher branches of nearly every department of the industry, particularly, however, in electricity supply, and in manufacturing.

The lecturer then spoke of the value to students of visits to works, either at home or abroad, and illustrated his remarks by a series of lantern views of Swiss water power stations.

The remainder of the lecture was devoted to a consideration of some of the fields in which future progress in electrical engineering work would probably be made. Amongst these the manufacture of fertilisers was awarded a prominent place. Briefly describing how the electric furnace was made use of in the industrial fixation of nitrogen, he showed how, shortly, 140,000 h.p., and eventually 400,000 h.p., would be used by one company for this purpose alone, the waterfalls of Norway being utilised as the source of power.

The direct utilisation of the sun's energy, the wireless transmission of power, the improvement of lighting and heating appliances and the development of electrically-propelled vehicles were also referred to, the lecturer concluding by impressing on his hearers the supreme importance of character, and urging upon them the advice, "Whatsoever thy hand findeth to do, do it with thy might."

Mr. Mordey, in proposing a vote of thanks to the lecturer, spoke of the pitfalls which beset the college-trained youth on first entering a works, and emphasised the need for doing the work allotted to him as well as any workman, so that when it was necessary to find foremen and managers these posts would naturally fall to his share. He referred to the small proportion of patents which proved commercial successes, expressing the opinion that the greater part of the profit made out of them went to patent agents, who at any rate were sure of their fees.

He thoroughly agreed with what had been said as to the need for character, it was this as much as anything which had given the British engineer the world over such a high reputation.

**The "Model Engineer" Exhibition.** — Sir Hiram Maxim will perform the opening ceremony at the "Model Engineer" Exhibition at the Royal Horticultural Hall, Westminster, at 12 o'clock to-day (Friday). Over 200 entries have been received in the competitions, including a large number of model aeroplanes of all types.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GIBRALTAR.—No duties are levied on electrical materials.

GOLD COAST.—The following goods are admitted free of duty:—All goods imported for the use of His Majesty's troops or His Majesty's ships; all goods imported with the sanction of the Governor of the colony for the service of any public department of the colony; apparatus and structural material for telegraphs, telephones and electric lighting; cranes, &c., and machinery necessary for working the same; instruments and appliances for scientific purposes and research; machinery for electrical, manufacturing, pumping, mining and gold-dredging purposes, and machinery for use in the preparation of any natural product of the colony or the development of any industry in connection with such product; plant, material and rolling stock for tramways; railway plant, material and rolling stock; vehicles possessing their own means of propulsion. Goods not specially mentioned in the Tariff 10 per cent. *ad valorem*.

NOTE.—No person may establish or use in the Gold Coast Colony any apparatus or installation for the purpose of electrical communication by wireless telegraphy without a licence from the Governor.

GREECE.—Invoices and consignment notes should state the gross weight of packages and net weight of contents, which should be fully described, and the country of origin stated. When various descriptions of merchandise are packed together, the net weight of each class should be stated separately. Certificates of origin should be supplied for ordinary merchandise. A statutory declaration of origin is, however, accepted. Unenumerated goods which, according to the letter or spirit of the tariff, are not capable of being, by analogy, embraced in any class of the tariff, are dutiable at the rate of 20 per cent. *ad valorem*, the value of the goods for calculation of *ad valorem* duty being the market value at the place of importation, excluding the amount of Customs duty payable.

The following duties are payable:—

Drachma = $9\frac{9}{10}$d., or 25 drachmas = £1.

Oke = 2·8 lb.

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| Iron in plate bars (without grooves like rails), in plates of all dimensions for building and other purposes; in ties for walls; in rolls, hoops, strips, &c. | free. |
| Steel in bars, sheets or pieces | " |
| Copper in blocks, bars, or sheets | 40 drachmas per 100 okes. |
| Brass in sheets up to 5 cm. in width | free. |
| Wire for telegraphs, or for other purposes of all kinds, of iron, steel or copper, pure or alloyed with other metals | free. |
| Articles of porcelain of every kind, white and plain | 50 drachmas per 100 okes. |
| Lamps and all other kinds of fancy or artistic ware | 7 " " " |
| Glassware not specially mentioned in the Tariff, white, plain or pressed of one colour but tinted in the mass | 30 drachmas per 100 okes. |
| Ditto cut or engraved | 75 " " " |
| Ditto decorated with gold or colours, or tinted in the mass with more than one colour and articles of crystal | 150 drachmas per 100 okes. |
| Iron rails, points and bridges of cast-iron for railroads | free. |
| Iron pipes, T-iron and other girders | 8 drachmas per 100 okes. |
| All kinds of wrought-iron goods not polished, burnished, or gilt but only tinned, varnished, glazed, painted or filed | 25 " " " |
| All kinds of wrought-iron goods polished, burnished, gilt, or galvanised | 50 " " " |
| Lamps of all sorts, of iron | 1 " " oke |
| Boilers of all kinds | free. |
| Articles of copper not specially mentioned: | |
| Plain and of coarse workmanship | 50 drachmas per 100 okes |
| Chased, gilt or enamelled | 2 " " oke |
| Decorated with precious metals | 3 " " " |
| Articles of brass or bronze: | |
| Common wares | 1 drachma " " |
| Chased, gilt or enamelled | 2 drachmas " " |
| Ornamented with precious metals | 3 " " " |
| Lead pipes | 25 " " 100 okes |
| Electric telephones, microphones, electric bells, buttons for electric bells and electric light, indicating boards for electric bells and telephones, telegraph apparatus, and parts of all the above | 6 " " oke |
| Railway or tramway cars for goods or passengers | 10 % ad val. |
| India-rubber or gutta-percha in sheets, bands, pipes, hose, &c., combined or not with other materials | free. |
| Other manufactures of india-rubber or gutta-percha not separately mentioned | 500 drachmas per 100 okes |
| Dynamo electric machines | free. |
| Electric lamps: | |
| If of glass | 1 drachma per oke |
| If of plain porcelain | 50 drachmas per 100 okes |
| If of porcelain, inlaid, coloured or gilt | 200 " " " |
| All others | According to material of which made. |

## NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,957. "Improvements in and relating to electric motor-controlling apparatus." J. WHITELAW and B. A. MALKIN. September 27th.

21,978. "Improvements in automatic telephone exchanges for calling one of several subscribers on the same line." SIEMENS & HALSKE AKT.-GES. (Date applied for under Sec. 91 of the Act, November 19th, 1908, being date of application in Germany.) September 27th. (Complete.)

21,998. "Improvements in electric cables." A. E. TANNER and E. A. CLAREMONT. September 27th.

22,029. "Socket and plug for electric lamps and other apparatus utilising electric current." A. DENEREAZ. September 27th. (Complete.)

22,062. "Improvements in or relating to electric pocket lamps." J. LAWY September 27th. (Complete.)

22,072. "Electric vibration pad." C. HEITMAN. September 28th.

22,087. "Improvements in or relating to trolley-arms or collectors for electrically-propelled vehicles running without rails." E. M. MUNRO and RAILLESS ELECTRIC TRACTION Co., LTD. September 28th.

22,125. "Improvements in the illumination of looms by means of electric lamps." A. C. KOECHLIN. (Date applied for under Sec. 91 of the Act, July 16th, 1909, being date of application in Germany.) September 28th. (Complete.)

22,133. "Improvements relating to pads or cushions for telephone receivers and similar instruments." H. A. CUTMORE. September 28th.

22,141. "Improvements in and relating to switching devices for alternating current circuits." A. C. HEAP. September 29th.

22,142. "New and improved method for transmitting power by surface contact." September 29th.

22,149. "Automatic working of tramway points as applied to electric cars for the streets." J. J. ARMSTRONG. September 29th.

22,227. "Improvements in flame arc lamps." C. E. G. GILBERT. September 30th.

22,234. "Improvements in apparatus for electrically operating planing-machines and the like reciprocating tools." LANCASHIRE DYNAMO AND MOTOR Co., LTD., and G. E. MASON. September 30th.

22,273. "Improvements in and relating to electric-filament lamps." J. MESZAROS, S. FAWNS and A. E. MCCRACKEN. September 30th. (Complete.)

22,302. "Improvements in or relating to a method of working arc lamps in series with incandescent lamps." A. HEIMANN and W. SCHAFFER. (Date applied for under Sec. 91 of the Act, October 1st, 1908, being date of application in Germany.) September 30th. (Complete.)

22,385. "Improvements in or relating to electric switches and the like." T. G. HOWE and F. H. TAYLOR. October 1st. (Complete.)

22,450. "Improved magnetic switch." D. S. DAVIES. October 2nd.

22,452. "Improvements in alternating-current generators and motors and applications of them." H. V. FLINN. October 2nd.

22,454. "Improvements in electrical capstans, electrical cranes, and other electrical lifting, winding, or hauling appliances." ROYCE, LTD., and R. D HULLEY. October 2nd.

22,458. "Metal-filament lamps having filament carriers arranged elastically." O. KRAUSE. (Date applied for under Sec. 91 of the Act, June 10th, 1909, being date of application in Germany.) October 2nd. (Complete.)

22,491. "Improved apparatus for rectifying alternating currents." E. GIGLIO. (Application for Patent of Addition to No. 17,742, 1909.) October 2nd.

22,507. "New or improved apparatus for use in connection with telephones for recording and registering the number of calls made." F. E. CHURCHARD and H. J. GORE. October 2nd.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1908.

METHOD OF AND APPARATUS FOR CONTROLLING THE VOLTAGE OF DYNAMO-ELECTRIC MACHINERY, ESPECIALLY APPLICABLE TO VARIABLE SPEED GENERATORS. W. Stansfield and J. J. Hatt. 12,704. June 13th.

ELECTRICAL DEVICES FOR PRODUCING PERIODICAL AND INTERMITTENT MOTION. W. Vetter and C. Mürer. 19,151. September 11th.

ELECTRIC MOTORS FOR DRIVING SUBMERGED PUMPS. W. R. Macdonald. 19,384. September 15th. Post-dated March 11th, 1909.

ELECTRIC ARC LAMPS. H. Jaburg. 19,395. September 15th.

ELECTRIC TELEGRAPHY. A. Muirhead. 19,450. September 16th.

DYNAMO-ELECTRIC MACHINES FOR OPERATING ROLLING MILLS AND THE LIKE. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 19,485. September 16th.

REGULATION OF DYNAMO-ELECTRIC MACHINERY. Akt. Ges. Brown, Boveri et Cie. 19,921. September 22nd. (Date applied for under International Convention, February 3rd, 1908.)

ELECTRIC LIGHTING ARRANGEMENTS FOR DRESSING TABLES, MIRRORS AND THE LIKE ARTICLES. E. M. Ashley. 26,145. December 3rd.

INCANDESCENT ELECTRIC LAMPS. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 26,257. December 4th.